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Habitat Evaluation of the Upper Des Plaines River and Adjacent Wetlands, 1979-80

ENCAP, Inc.
DeKalb, IL

Prepared for

Environmental Protection Agency
Chicago, IL

18 Dec 80

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HABITAT EVALUATION OF THE UPPER DES PLAINES RIVER AND ADJACENT WETLANDS, 1979-80

FINAL REPORT

Project Leader: William E. Southern, Ph.D.
ENCAP, Inc.

Submitted to: U.S. Environmental Protection
Agency, Region V

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Date submitted: 18 December 1980

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16. ABSTRACT

From October 1979 through November 1980, a wetland habitat evaluation study was conducted on the Upper Des Plaines River wetlands near the village of Pleasant Prairie, Wisconsin. The study was designed to address the following subjects:

1) Species diversity, seasonal occurrence and relative abundance of non-game and game bird species.
2) Frequency and type of bird use of the area during migration (spring and fall) and during the breeding season.
3) Seasonal occurrence and relative abundance of fish species.
4) Use of the area for spawning, rearing, and residency by fishes.
5) Occurrence of invertebrate species in the river and associated wetlands.
6) Occurrence of other wetland vertebrate species such as mammals, reptiles and amphibians.
7) Occurrence and distribution of plant species and their respective associations.
8) Presence of threatened or endangered species (Federal and State listed) of plants or animals.

Information pertinent to each of the abovementioned subjects was used to formulate conclusions about 1) the characteristics and qualities of the plant communities; 2) the value of the plant communities as habitats for birds, mammals and fishes; and 3) the suitability of the area for continued use by wetland species of plants and animals.

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This report originally included four volumes. This document includes Volumes 1 (Parts 1 - 5)and 2 (Parts 6 - 8) which contain the summarized field data, evaluations of the wetland based upon the results of each biotic inventory, and an overall evaluation which gives consideration to wetland values not considered in the other sections (e.g., recreation, hydrology). This document does not include Volumes 3 and 4 which contain a series of photographs depicting habitat characteristics of the wetland, particularly portions of the area designated as Survey Areas 1-5. For information regarding Volumes 3 and 4 contact the consultant directly.

ENCAP, Inc.

Environmental Consultants and Planners

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18 December 1980

Mr. William D. Franz
U.S. Environmental Protection Agency
Region V, Office of Federal Activities
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. Franz:

I am pleased to submit this Final Report covering our evaluation of the Des Plaines River wetlands in Kenosha County, Wisconsin. Field work associated with this project was terminated on 14 November 1980. Data analysis and interpretation were completed thereafter. This report contains a detailed accounting of the biota encountered and a series of evaluations of wetland quality based on this evidence.

The Des Plaines River wetland is a rich and diversified resource that benefits the region through the performance of many natural services, such as wildlife production, aquifer recharging and flood control. We were impressed by its residual quality as it has survived obvious attempts to destroy its natural values. It is the unanimous opinion of our research teams that this area is of sufficient quality to be preserved as a wetland.

This report is presented as four volumes. Volumes 1 and 2 contain the summarized field data, evaluations of the wetland based upon the results of each biotic inventory, and an overall evaluation which gives consideration to wetland values not considered in the other sections (e.g. recreation, hydrology). Volumes 3 and 4 contain a series of photographs depicting habitat characteristics of the wetland, particularly portions of the area designated as Survey Areas 1-5. Other photographs, including color slides, remain in the files of ENCAP, Inc. This latter group of photos includes records of each bird nest observed on the Project Area.

If the need arises, we will be pleased to assist in the interpretation of any portion of this report.

Sincerely yours,

William E. Southern
Project Leader

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PART 1: DESCRIPTION OF PROJECT AREA AND OBJECTIVES

DESCRIPTION OF WETLANDS

The U.S. Environmental Protection Agency, in cooperation with the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources, contracted this study of the Upper Des Plaines River and its adjacent wetlands in Kenosha County, Wisconsin. The purpose of the study was to ascertain the ecological value of the wetlands within the designated study area.

A "wetland" is described by the U.S. Fish and Wildlife Service as land where water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Ref. 1). This definition is similar to the one used by the U.S. Army Corps of Engineers in its regulatory program and appearing in the Executive Order signed by President Carter in May 1977 (Ref. 1). In these latter instances, wetlands are described as areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. The term wetlands, in accordance with these definitions generally includes marshes, wet meadows, bogs, swamps, floodplains and similar areas. The value and/or quality of a wetland is not contingent upon how natural it is according to the accepted definitions. Instead, quality is evaluated in terms of the biotic components of the area, particularly those species that serve as indicators of habitat conditions.

To qualify as a wetland an area may be continuously submerged or only intermittently inundated by seasonal river flooding. Most such areas are readily identifiable by the presence of typical emergent vegetation or by submerged types of plants. The types of plant life found in a wetland are influenced by the depth, chemistry, temperature, and seasonal occurrence of water. The resulting assemblages of plants and their distribution within a wetland provide conditions for a wide array of birds, fishes, mammals, mollusks, crustaceans, insects and a variety of microorganisms to secure food and shelter. If marked changes in water quality or quantity occur, modifications in the vegetative cover, and the associated animal life, may serve as testimony to these types of alterations. Wetlands are necessarily responsive to fluctuations in annual precipitation rates. They usually exist at the interface between terrestrial uplands and the aquatic lowlands, and dynamically reflect, through vegetative cover, the varying patterns in water availability. The boundaries of some wetlands, particularly those associated with riverine systems, must be delineated on the basis of two sets of water conditions: 1) the limits of permanent or semipermanent stands of open water and emergent plants; and 2) the limits of seasonal flood waters as determined by land contours and predicted flow rates (e.g. 100-year flood).

Freshwater marshes, such as those found in the Great Lakes Region, are usually covered by shallow water. The water level rises during periods of heavy rainfall or heavy river runoff and recedes during dry periods. The water supply of marshes may originate from ground water, surface springs, streams, upland runoff, rainwater, or from a combination of such sources. Marsh vegetation is characterized by soft-stemmed plants, particularly grasses, sedges, cattails and rushes.

GENERAL PROJECT DESCRIPTION

Lands lying within the floodplain of the Des Plaines River in Kenosha County, Wisconsin are appropriately described as wetlands. The quality of such wetlands, or their value, is reflected by 1) their importance in harboring biotic communities (fish and wildlife values); 2) their potential recreational value for local residents; 3) their ability to retain and retard flood waters; 4) their contribution to purification of water by reducing silt or nutrient loads; and 5) their role in recharging local ground water supplies.

From October 1979 through November 1980, a wetland habitat evaluation study was conducted on the Upper Des Plaines River wetlands near the village of Pleasant Prairie, Wisconsin. The study was designed to address the following subjects:

1) Species diversity, seasonal occurrence and relative abundance of non-game and game bird species.
2) Frequency and type of bird use of the area during migration (spring and fall) and during the breeding season.
3) Seasonal occurrence and relative abundance of fish species.
4) Use of the area for spawning, rearing, and residency by fishes.
5) Occurrence of invertebrate species in the river and associated wetlands.
6) Occurrence of other wetland vertebrate species such as mammals, reptiles and amphibians.
7) Occurrence and distribution of plant species and their respective associations.
8) Presence of threatened or endangered species (Federal or State listed) of plants or animals.

Information pertinent to each of the abovementioned subjects was used to formulate conclusions about 1) the characteristics and qualities of the plant communities; 2) the value of the plant communities as habitats for birds, mammals and fishes; and 3) the suitability of the area for continued use by wetland species of plants and animals.

LOCATION AND GENERAL DESCRIPTION OF PROJECT AREA

Topographical Features of the Project Area

The Des Plaines River watershed lies in eastern Kenosha County. The drainage pattern of the area is referred to as parallel, with the major waterways lying in broad, poorly drained valleys oriented in a north-south direction, and separated by low, wide, recessional moraines that parallel the shore of Lake Michigan. This arrangement of moraines influences drainage so that the Des Plaines River, the area's major waterway, flows within six miles of Lake Michigan yet remains part of the Mississippi River Basin. The Des Plaines River originates in Racine County and drains 143 square miles within Wisconsin, principally in Kenosha County. The soils here are predominantly heavy silt and clay loams with poor or deficient internal drainage. Since the silt loams are desirable for agriculture, efforts to drain area wetlands have been extensive (Ref. 2).

In 1961, the surface water resources of Kenosha County were inventoried by the Wisconsin Department of Natural Resources (DNR) (Ref. 2). In that report, the Des Plaines River was considered as having three branches: the Center Branch (Paris and Bristol twps.; 6.7 miles long); the East Branch (Somers and Pleasant Prairie twps.; 10.0 miles); and, the Main Branch (Paris, Bristol and Pleasant Prairie twps; 17.5 miles). At the time of this survey, no wetlands of value to fisheries remained along the Center Branch. Poss and Threinen (Ref. 2) advised that prior to extensive drainage along the stream, much value was realized from the excellent duck hunting it offered. The East Branch had only 76.5 acres of marshy wetland remaining along its 10-mile length. At that time, these areas were used in spring by spawning northern pike and the stream was said to be managed for forage fishes, presumably by the DNR (Ref. 2). The most extensive wetland area (851 acres) was located along the Main Branch as continues to be the case today. This latter area was referred to as an important duck hunting area as well as a spawning area for northern pike. The lower portion of this section of the Des Plaines River was managed for northern pike and forage fishes (Ref. 2). Based on this information, it appears that the Des Plaines River wetlands of Kenosha County represent a remnant of more extensive wetlands that once were associated with the river.

Most of the natural features of the area reflect a long history of agriculture. The Des Plaines River system has lost much of its wetlands through drainage (Ref. 2). Parts of the wetland area near Kenosha have been diked and adjacent canals have drained large portions of the area. Portions so drained probably were farmed at one time but all have now reverted to reasonably typical associations of wetland flora. The canals remain full of water as pumps are no longer present to lift the water over the dikes or because existing water control devices are plugged by mud. Beavers and muskrats have expedited deterioration of the dikes thereby allowing water to flow from the canals during high water back into the adjoining lowlands. Although influenced by the activities of humans, the low-lying areas bordering the river continue to function in their capacity as a floodplain and as wetlands according to the aforementioned definitions. According to the Wisconsin Department of Natural Resources, this wetland and floodplain (i.e. the Project Area) probably represent the last extensive wetland in southeastern Wisconsin (Ref. 3). Historically this area has been identified as having significant fish and wildlife value.

Location of the Project Area

The principal portion of the Project Area is located in Pleasant Prairie Township (Kenosha County), Sections 13, 14, 19, 20, 29, 30, 31 and 32. Emphasis was placed on the river and wetlands lying north of County Highway ML, east of I-94, west of County Highway H, and south of County Highway C (Fig. 1-1). In addition, aerial surveys of waterfowl were conducted along the river farther north and west to include Section 7 in Pleasant Prairie Township and portions of Sections 12, 13, 14, 15 and 16 in Bristol Township. Occasional aerial surveys extended as far west as Section 19 in Bristol Twp. to include the site of a Great Blue Heron colony. Herons from this colony foraged on the Project Area but nested colonially in a woodland in this section. The Project Area is about 60% floodplain and marshes that are associated with the Des Plaines River (Fig. 1-2 A&B). The upland portion, about 40% of the area, is currently wooded, agricultural, or residential. Approximately 900 acres, largely floodplain and marsh, is used for recreational purposes by members of the Pheasant Valley Hunting Club. Another parcel of land, located directly west of the Hunting Club on the opposite side of the Des Plaines River (about 200 acres) is owned by the Girl Scouts of America and is used primarily for educational and recreational purposes.

Des Plaines River Water Data

According to the U.S. Army Corps of Engineers, the water surface elevation at a 100-year flood would be about 677.4 feet (Ref. 3). This is about 6 feet above the floodplain adjacent to the Des Plaines River. Flow of the Des Plaines

River has varied from zero during drought conditions to 4000 cubic feet per second (cfs) during flood conditions. Estimated volume at the 100-year flood is 6820 cfs (Ref. 3). Portions of the Project Area designated as floodplain by the U.S. Department of Agriculture Conservation Service, on the basis of 100-year flood statistics, are shown in Figure 1-2 A&B. Precipitation supplying surface water amounts to 31-33 inches per year in this area (Ref. 2).

Figure 1-3 and Table 1-1 show the volumetric flow or discharge rate of the Des Plaines River recorded by the U.S. Geological Survey's (USGS) stream gaging station near Russell (Lake Co.), Illinois. This USGS station is that closest to the Project Area and the most appropriate one to reflect flow rates through the Kenosha County wetland since it is located immediately south of the area. The volumetric flow is the total volume of water passing a given point during a specific period of time and is expressed in cubic feet per second. The maximum or peak discharge listed in Table 1-1 is the greatest discharge for a single day during each month. Periods of high flow usually reflect precipitation rates but associated factors, such as frozen ground, also may influence the proportion of precipitation or snow melt that runs off into the river.

CLASSIFICATION OF THE DES PLAINES WETLANDS

The Des Plaines River wetlands near Kenosha can be characterized as a Riverine System with an associated Palustrine System, in accordance with the most recent U.S. Fish and Wildlife Service wetland classification procedures (Ref. 4).

The Riverine System (Fig. 1-4) includes all wetlands and deepwater habitats contained in a channel, with the exception of freshwater wetlands dominated by trees, shrubs, or persistent emergent vegetation. A channel is "an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water." The Riverine System is bounded on the landward side by upland, by the channel (including natural and manmade levees), or by wetland dominated by trees, shrubs, or persistent emergents (Ref. 4). Springs discharging into a channel are considered part of the Riverine System.

Water is usually, but not always, flowing in a Riverine System. Upland islands or Palustrine wetlands may occur in the channel but they are not included as part of the Riverine System. Palustrine wetlands also may occur adjacent to the Riverine System, often on a floodplain. Many biologists have suggested that all wetlands occurring on a river floodplain should be part of the Riverine System. Since some floodplains are only occasionally flooded, it is subsurface water (the ground water) that controls to a great extent the water level in swamps and marshes. Consequently such areas are excluded from the Riverine System in the new classification system (Ref. 4).

The Palustrine System (Fig. 1-5) includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent plants. It also includes wetlands lacking such vegetation, but showing all of the following four characteristics: 1) areas less than 8 ha (20 acres); 2) active wave-formed or bedrock features lacking; 3) water depth in the deepest part of the basin less than 2 meters (6.6 ft) at low water; and 4) salinity due to ocean-derived salts less than 0.5% (Ref. 4). This system includes vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and wet prairie. It also includes the small, shallow, permanent or intermittent water bodies called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; or in isolated catchments (Ref. 4).

Each System is subdivided into classes based on the general appearance of the habitat in terms of either the dominant life form of the vegetation or the physiography and composition of the substrate (Figs. 1-4 and 1-5). Special modifiers are included in the classification system since many wetlands are manmade or are natural ones that have been modified to some degree by humans or beavers. The following modifiers are applicable in the Des Plaines Palustrine System: dikes; partly drained; and possibly farmed (Ref. 4).

REPORT ORGANIZATION

The project consisted of four major parts: 1) a bird inventory directed by Dr. William E. Southern; 2) an inventory of fishes directed by Dr. David W. Greenfield; 3) an invertebrate inventory conducted by Dr. Carl von Ende; and, 4) a plant inventory directed by Dr. Paul D. Sørensen. Dr. Southern served as project director and coordinated the various aspects of the study. In addition to the above, Dr. Southern's team of investigators recorded all encounters with vertebrate species other than birds (e.g. mammals, reptiles and amphibians) during their 14-month study period.

The results from each major part of the study are presented in their entirety. That is, the methods, study area descriptions and results for each are contained as a separate part of this report. Scientific names of species inventories on the Project Area are presented in tabular form in the part of the report dealing specifically with that taxonomic group. Following presentation of the baseline data and a habitat evaluation based on the needs of the respective biota, a section is devoted to an overall evaluation of the quality of the Des Plaines River wetlands as evidenced by our combined findings. A series of photographs denoting the ecological and physical characteristics of the Project Area, particularly Survey Areas 1, 2 and 4, is included as Appendix 1. Aerial photographs of the Project Area also are included.

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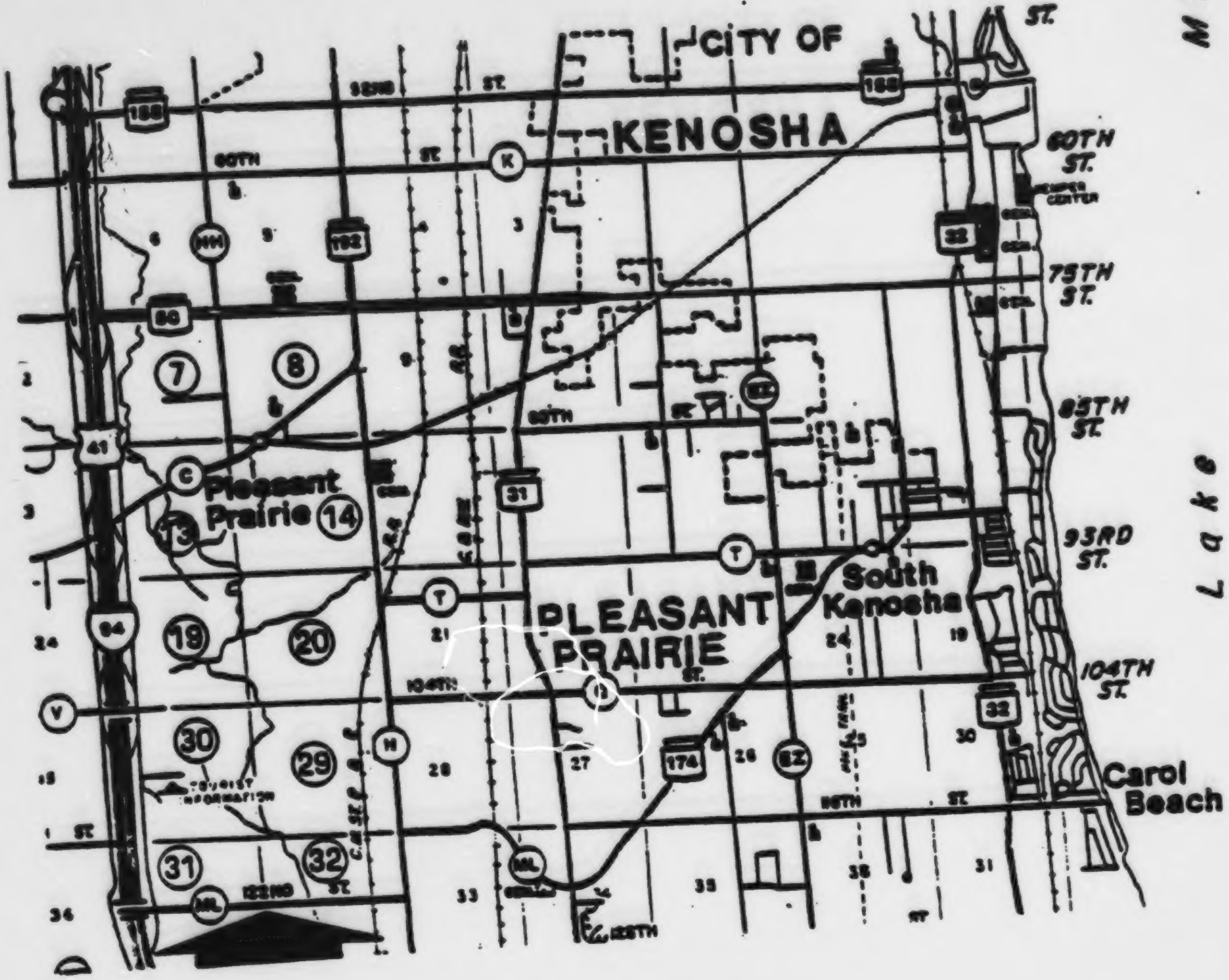
CITY OF
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Pleasant Prairie
PLEASANT PRAIRIE
South Kenosha
Carol Beach
Lake Mi
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Figure 1-1. Location of Project Area in Kenosha County, Wisconsin. The section numbers for each section in the Project Area (at tip of large black arrow) are enclosed by circles. The entire Project Area is within Pleasant Prairie Township.

Figure 1-2A. Floodplain topographic map for the Des Plaines River north of County Highway ML. Bird Survey Areas 1-5 are within this area. The shaded areas bordering the river represent the 100-year floodplain. The darkest portions of the shaded area depicts standing water. (From Ref. 6.)

Figure 1-2B. Northern continuation of Figure 1.2A showing the 100-year floodplain near Pleasant Prairie. Fish and invertebrate sampling areas included this part of the floodplain. (From Ref. 6.)

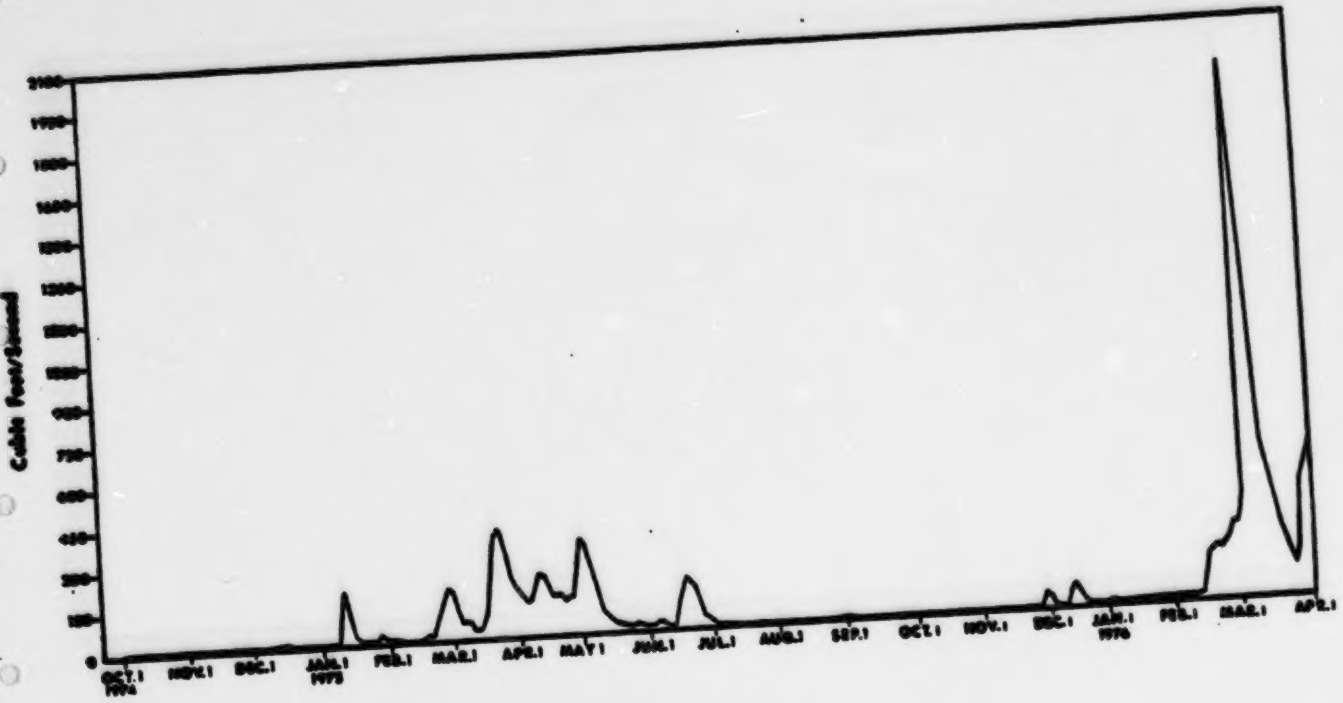

Figure 1-3. Hydrograph of the mean daily discharge of the Des Plaines River at Russell, Illinois from October 1974 through March 1976 (USGS data). Figure taken from Ref. 5.

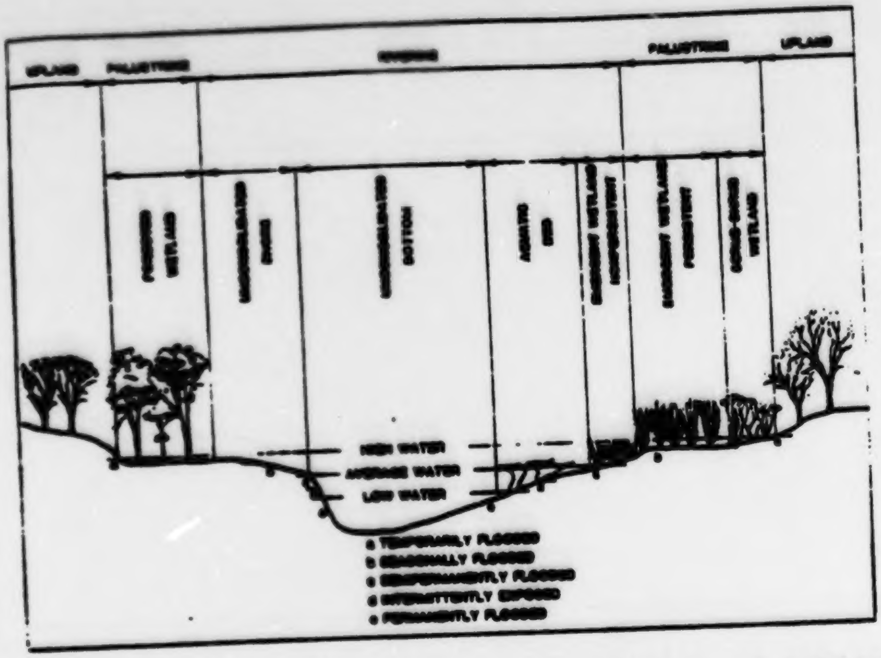
UPLAND
PALUSTRINE
RIVERINE
PALUSTRINE
UPLAND
FORESTED WETLAND
UNCONSOLIDATED SHORE
UNCONSOLIDATED BOTTOM
AQUATIC BED
EMERGENT WETLAND NONPERSISTENT
EMERGENT WETLAND PERSISTENT
SCRUB-SHRUB WETLAND
HIGH WATER
AVERAGE WATER
LOW WATER
a TEMPORARILY FLOODED
b SEASONALLY FLOODED
c SEMIPERMANENTLY FLOODED
d INTERMITTENTLY EXPOSED
e PERMANENTLY FLOODED

Figure 1-4. Distinguishing features and examples of habitats in the Riverine System. From Ref. 4.

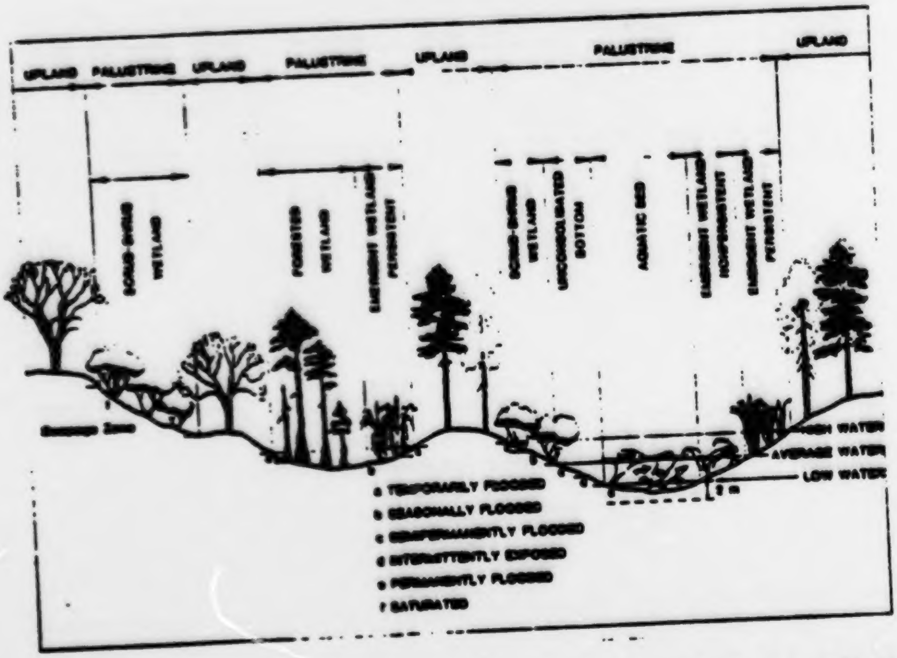
UPLAND
PALUSTRINE
UPLAND
PALUSTRINE
UPLAND
PALUSTRINE
UPLAND
SCRUB-SHRUB WETLAND
FORESTED WETLAND
EMERGENT WETLAND PERSISTENT
SCRUB-SHRUB WETLAND
UNCONSOLIDATED BOTTOM
AQUATIC BED
EMERGENT WETLAND NONPERSISTENT
EMERGENT WETLAND PERSISTENT
Seepage Zone
HIGH WATER
AVERAGE WATER
LOW WATER
2 m
a TEMPORARILY FLOODED
b SEASONALLY FLOODED
c SEMIPERMANENTLY FLOODED
d INTERMITTENTLY EXPOSED
e PERMANENTLY FLOODED
f SATURATED

Figure 1-5. Distinguishing features and examples of habitats in the Palustrine System. From Ref. 4.

Table 1-1. Mean monthly discharge (cfs) of the Des Plaines River at Russell, Illinois from October 1978 through June 1980.*

	1978			1979			1980 **		
	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.
JAN				13	15	11	27	60	10
FEB				17	30	13	25	115	8
MAR				673	2100	32	58	154	15
APR				432	1000	130	228	341	89
MAY				181	698	21	47	101	22
JUN				65	257	14	66	212	13
JUL				20	103	4			
AUG				68	263	4			
SEP				25	183	2			
OCT	32	58	18	4	7	2			
NOV	25	49	14	12	44	3			
DEC	32	81	16	42	170	8			

* Data provided by the U.S. Geological Survey, DeKalb, Illinois. Station number: 05527800. Location: lat 42°29'22"N, long 87°55'32"W, in SE ¼ sec. 3, T46N, R11E, Lake County, Illinois.

** Data for July through October 1980 were not available from the U.S.G.S. at the time of report preparation.

PART 2: BIRD INVENTORY AND HABITAT EVALUATION

William E. Southern, Ph.D.

INTRODUCTION

The relative abundance of bird species using the Project Area was monitored periodically between 19 October 1979 and 14 November 1980. Representative portions of the wetlands were traversed by a team of ornithologists who recorded 1) species present; 2) number of individuals present; 3) portion of the available habitat being used; and 4) the type of use by each species (e.g. foraging, nesting). Scientific names for birds mentioned in the text are listed in Table 2-8.

METHODS

Bird inventories were conducted on 42 days (168 man-days) between 19 October and 17 November 1979, and 26 March and 14 November 1980 (see Table 2-1 for dates). A team of four ornithologists, under the direction of Dr. William E. Southern, conducted the bird surveys. Each field survey began near dawn and continued until the selected areas were covered in entirety. Four procedures were used to provide information about the species of birds using the Des Plaines River wetlands: 1) birds were counted by the observers as they walked systematically along transects across each of five Survey Areas (Fig. 2-1) selected as representatives of the available wetland habitats; 2) helicopter surveys covering the entire Project Area were flown during spring and fall periods; 3) perimeter roads, trails within the wetland, and other access points throughout the Project Area were visited on each count date thereby providing supplemental information about birds using the entire wetland system and the associated uplands; and 4) a breeding bird survey of wetland species was conducted in 1980 wherein intensive searches for nests were made on a weekly basis. The observers recorded the species of birds encountered and the actual or approximate number (in the case of large flocks) of each species. Nests were marked and coded for individual recognition in order to prevent duplicate counts and to provide some information about reproductive success.

Bird Survey Areas

Five Survey Areas were selected within the wetland complex for sampling purposes. The areas varied in size, amount and type of vegetative cover, and with respect to the amount and depth of open water. Four of the areas were located along or near the proposed corridor for the extension of County Highway Q (Fig. 2-1). The remaining area was situated slightly farther south. Areas 1, 2 and 4 were selected as being representative of habitats holding the greatest potential for use by waterfowl, marsh birds and other wetland species. Sampling these areas provided a means of evaluating the quality of existing wetland habitats for birds that are dependent upon flooded terrain, vegetative cover typical of wetlands, and an assortment of aquatic organisms as food. Areas 3 and 5 included, or were close to, open water but both were covered with dense stands of river bulrush. In both these areas, there was an absence of interspersed water that is useful to many avian species typically found in marshes.

In the fall of both years, hunter activity influenced our counts. Occasionally hunters were present during our surveys and their presence, particularly in 1979, either prevented us from censusing a particular area or their activities caused some birds, particularly waterfowl, to depart. Hunter activity probably reduced the number of ducks that remained on the area to be counted by us. The level of disturbance was probably great enough to cause some waterfowl to seek areas having less human activity. It is likely, therefore, that our fall counts of waterbirds represent the minimum number of each species to be expected on the Project Area during this season. Our data for spring supports this contention as many more ducks frequented the wetlands during this season when human disturbance was minimal.

Survey Area 1 (Fig. 2-1) included the eastern segment (about one-half of the length) of the "Q" canal, the pond at the eastern terminus of the canal, a narrow strip north of the canal and the flooded expanse south of the canal that is bordered by woodland to the south and a short north-south canal to the west (Sections 20 and 29). This area comprises about 55 acres (20.4 hectares) of wetland. The canals provide deep open water (1.5-2.0 meters) as do pools where emergent vegetation is sparce. The clonal distribution of cattails, bulrushes and reeds results in a good interspersion of water and plants. Surface plants (e.g. duckweed) and submerged plants occur throughout the area. Water quality appears good as there is little turbidity. In the fall of 1980, the bottom of the south canal was clearly visible through about 1.8 meters of water. Reed canary grass and other grasses occur on the moist soils surrounding the area. The arrangement of open pools of water interspersed with emergent vegetation and some brush provides good habitat for foraging waterfowl. Sufficient vegetation exists in the area to provide nesting cover for typical wetland species, such as grebes, rails, and bitterns.

Water depth varied somewhat between 1979 and 1980 as a result of different precipitation rates. September of 1979 was an unusually dry month; consequently water levels probably were near the expected low for the wetlands. This area was surrounded by a narrow mud zone and a shallow (1-10 cm deep) vegetated area in 1979 that was ideal for species such as Common Snipe. Central portions of the marsh remained 0.5-1.5 meters deep and provided optimal conditions for foraging and resting waterfowl. Duck hunters had two blinds toward the west end of this area. Fall of 1980 also had low precipitation rates, but the summer was unusually wet. As a result, water levels were generally higher throughout 1980 (late April-November). Shallows and mud flats did not exist along the shoreline, instead the fluctuation in water level that occurred was restricted to the grass-covered perimeter. In 1980, water depth ranged to 1.75 meters (deeper in the canals) and an additional 25-30 meters of shoreline was flooded during most of spring through early fall. Over the entire study period, water depth in the emergent vegetation zone ranged between 0.5 and 1.75 meters. During late spring and early summer the water level reached, and in some places exceeded, the height of the "Q" dike.

In October 1980, the water level in this area started declining at the rate of about 0.3 meters per week as a direct result of a valve at the west end of the east-west canal ("Q" canal) being opened. After two weeks of drainage, the valve was sealed and within another two weeks water levels had returned to their previous levels despite the lack of significant amounts of precipitation during this time. It appears, therefore, that ground water supplies in the immediate area are adequate for maintaining water levels that are suitable for waterbirds during most of the year.

Beaver activity in this area has influenced water levels by the cutting of canals through the dikes and construction of a dam just beyond the west end of the area. It appears that water levels have risen in Area 1 during recent years. Several cottonwoods and aspens, 10-25 centimeters in diameter, on the island near the area's center died during the last 1-3 years as a consequence of flooding. Other trees have been cut recently (1979) by beaver thereby setting back plant succession on the wetland. Wetland habitat quality is improving in this area as a result of deeper and more permanent water levels. Beaver also have dug canals between the dredged canal and the island which they use to transport material cut on the island to the deeper water of the dredged canal. Burrowing activity of muskrats along the dike also has weakened this structure, thereby reducing its water retention capability.

Survey Area 2 is located on the Girl Scout property (Fig. 2-1). It is bordered by an east-west canal on the north, a woodland to the east, a trail to the south and an upland area with some woods to the west. Included in the area is an elongated dredged pond (west side) and a shallow, apparently natural wetland pond (east side). Water depth in the emergent zone of Area 2 ranged to 1.75 meters. Deeper water occurred in the dredged pond and in the north canal. Diversity of vegetative cover was good on this 90 acre (37.5 hectares) area. Extensive stands of cattail, river bulrush, giant bulrush and common reed were distributed throughout the area. The water was clear and a good variety of other aquatic plants valuable to waterfowl were present. Muskrat activity was most prevalent in this area (particularly in 1980), as trapping is not permitted. The muskrat population appears to be staging a comeback following a decline about two years ago (Robert Vary, pers. communication). Beaver previously used the canal system at the northern border of the area but the lodge had been abandoned by the onset of our study. Fish, amphibians and reptiles inhabit the area.

The interspersion of water and vegetation is good throughout much of this area. Toward the southeast end of the area the topography is slightly higher and an area of wet sedges, flooded grasses and annual plant species provides good cover for rails, snipe and similar species. Water levels in Area 2 are not influenced by current beaver activity or by drainage efforts that might affect Area 1. Water levels remained suitable for wetland species of birds throughout the 1980 study period. In the fall of 1979, most of the area remained wet, but deep water (over 0.5 meters) was restricted mainly to the two ponds.

Survey Area 3 (Fig. 2-1) is located along the Des Plaines River toward the southern portion of the Project Area (Section 32). A pond (2 meters or deeper) is present near the east side of this area but the remainder is a fairly uniform stand of river bulrush. The vegetation is so dense that walking is extremely difficult. Because of the thickness of the vegetative cover, the area was not used by the variety of wetland species that frequented the more open areas with deeper water. Spring flood waters covered most of this area and for a short time the pond was linked to the river. Survey Area 3 consists of about 57 acres (23.8 hectares).

This area was not surveyed as intensively as some of the others due to 1) its relatively low productivity, and 2) the difficulties involved in walking through it. Several of the species expected to be most common in such densely vegetated moist habitats (e.g. rails) are seldom seen as they usually run beneath the plant growth rather than fly. An accurate census in this type of habitat is, therefore, difficult to accomplish.

Survey Area 4 (Fig. 2-1) is located north of the "Q" canal in the southwestern portion of Section 20. It is bordered to the west by an extension of the "Q" canal that parallels the Des Plaines River, to the north by upland agricultural land (west end) and a gravel operation (east end), and to the east by fill deposited from the gravel pit operation, some apparently natural upland and the pond included in Survey Area 1. This area contains about 55 acres (20.4 hectares) of wetland. A sizeable open pool (at least 2 meters deep) exists near the west end. Vegetative cover is diversified and interspersed with pools and channels of water suitable for waterbird use. Water depth ranges from 0.5 to 2.0 meters. A channel has been dredged through the northern half of this area. Water clarity is good in the western portion but considerable turbidity occurs to the east. Apparently this latter area was partially filled with spoil from the gravel operation. Silt associated with the fill is disturbed and placed in suspension by carp and/or wave action. The canal bordering the area to the south also is turbid, much in contrast to the one isolated from it on the opposite side of the dike. Part of the 1980 silt load in the canal was the result of runoff from the gravel operation by way of a ditch that parallels the railroad tracks.

During spring through summer 1980, a much greater proportion of this area was inundated than during the 1979 fall season. Water covered much of the previously filled area to the east. Areas with annual weeds and other nonaquatic forms of vegetation remained flooded through fall. Although impacted by previous filling operations, Area 4 represents reasonably good habitat for a variety of typical wetland birds. Fish, amphibians and reptiles inhabit the area. Muskrats are active and assist in maintaining the open character of the area. Duck hunter blinds were constructed on the area in 1979 and 1980.

Survey Area 5 (Fig. 2-1) borders the west end of Area 1 and the south side of Area 4. It is a small area of about 9 acres (3.8 hectares). Beavers occupied a lodge at the northeast corner of the site during 1979-80. A dam forms a semicircle south of the lodge and each end of it links up with the east-west dike ("Q" dike). A channel has been cut through the dike near the beaver lodge thereby permitting the water behind the dam to seek a level equal to that in the canal. The dam keeps Area 5 drier than it otherwise would be since it holds back about 0.5-0.75 meters of water. This water, however, would not be present on any part of Area 5 without the cut the beavers made in the dike. Water in Area 5 is usually only a few decimeters deep. The vegetative cover is primarily river bulrush and reeds. Water conditions in this area probably simulate to some extent the conditions that existed in Area 1 prior to beaver and muskrat perforating the dike and permitting water from the canal to enter the marsh. It appears, therfore, that beaver have done much to restore water levels to conditions approaching those that may have existed prior to the dredging and diking by humans. Only two muskrat houses were present on this area. No fish were observed. The normally shallow water (or perhaps non-existent) prior to beavers opening the dike has reduced the quality of this area for wetland species of birds such as waterfowl, bitterns, and Yellow-headed Blackbirds. Higher water would encourage the increase of the diversified characteristics important to these species.

Survey Procedures

Each survey area was divided into four variable width transects, each of which was covered by the same observer during each of the field surveys. Investigators walked slowly across each of the areas and recorded all birds flushed, observed within the vegetation, or noted while on the water. Procedures used to avoid duplication of sightings of any one bird or group of birds included: 1) observers staying in line and maintaining visual and/or verbal contact; 2) observers counting only birds flushed within their own transect boundaries; 3) observers recording some species (such as Common Snipe) only at the time of flushing and ignoring birds circling the area subsequent to flushing; and 4) observers notifying others on neighboring transects when a transient bird or flock of birds was being recorded.

Similar methods were used when searching for nests, except each person followed a meandering course through the survey area. Each nest located was numbered and a tag bearing that number was placed on vegetation about two meters from the nest. Nest contents were recorded during each subsequent visit to the area.

Aerial Surveys

Helicopter flights were conducted over the Project Area on 11 days in the fall of 1979 and the spring of 1980. About 30-40 minutes were spent over the Project Area and additional time was spent along the Des Plaines River west of I-94 and, occasionally, at a Great Blue Heron colony in Bristol Township. The portion of the Project Area covered during the helicopter flights is outlined by a white line in Figure 2-1. Helicopter flights followed transect lines that permitted examination of essentially the entire wetland area. When necessary we deviated from the straight line flight paths to examine particular areas more closely or to provide time to count birds occurring in large flocks. Two persons accompanied the pilot, one observer and a recorder. Dr. Southern assumed the responsibility of identifying and counting birds observed during all but one of the flights.

Flight altitude usually was maintained at 250-300 feet and ground speed was usually 40-60 kilometers/hour. Included in the aerial surveys was a large water-filled gravel pit in the northeastern part of the Project Area, a developed lake near Pleasant Prairie, the Pleasant Prairie sewage treatment lagoon, and the Des Plaines River starting 0.8 kilometers south of County Highway ML and meandering north and west across I-94 to a point where the river makes an abrupt northward turn (about 5.6 kilometers west of I-94). On two occasions, the aerial survey included the Bristol Township (Section 19) heron colony (about 8.6 km west of I-94 in line with County Highway V).

Supplemental Surveys

As the team moved between survey areas and during travel through the Project Area, all birds (except those believed to be released at the Pheasant Valley Hunting Club - primarily pheasants and Mallards) observed outside the specific survey areas were recorded. This procedure provided a supplemental list of birds using the Project Area. This list was kept separate from those maintained for each survey area and for the aerial survey but all data sets were combined to obtain a species list for the Project Area.

Photographic Documentation

Black-and-white and color photographs were taken of the survey area, characteristic vegetation, seasonal water levels, muskrat and beaver activity and nests of wetland bird species found on the Project Area. Copies of a series of black-and-white photographs are presented as Appendix 1. The color photographs have been retained in the files of ENCAP, Inc.

RESULTS

Species Reported from the Project Area (Ground and Aerial Surveys)

During October - November 1979 and March - November 1980, we recorded 173 species on the Project Area (Table 2-2). Nineteen of the species are waterfowl (ducks and geese), 7 are waders (herons and bitterns) and 12 are other typical waterbirds (loons, grebes, rails and gulls). We also recorded other typical wetland species that use shallow water habitats and associated seral communities, or are classified as perching (passerine) species. Included in this category are the following: Osprey, 10 shorebird species, Belted Kingfisher, Alder and Willow flycatchers, 6 swallow species, 2 wren species, Water Pipits, 6 warbler species, 3 blackbird species and 3 sparrow species. Of all avian species observed, 73 (42.2%) are characteristic of, or dependent upon, various types of wetland habitats. The occurrence of such a diversity of wetland forms and their relative abundance indicates that the Project Area is a highly productive area that is capable of supplying the needs (food, cover and water) of a great variety of species.

Waterfowl use of the area was highest in April and May (Table 2-2) and next highest during September and October. Lower use of the area by ducks during the fall probably was due, in part, to hunter activity. Mallard, Blue-winged Teal and Wood Duck were present throughout the breeding season. These data show conclusively that the Project Area is attractive to an array of waterfowl species and that it is capable of holding a large number of individuals. This means that a large supply of desirable food types are being produced on the flooded areas. At least 95% of the waterfowl counted during our aerial surveys were within the boundaries of the Project Area. A few ducks were observed south of County Highway ML and west of I-94 when portions of the floodplain were under water. Water characteristics on the Project Area are best suited for the dabbling ducks and this is reflected by the number of this group reported as compared to diving ducks and mergansers (Table 2-2). The most abundant diving duck was the Ring-necked Duck, which characteristically frequents open pools bordered by emergent vegetation.

At times when the river floods the adjacent lowlands, several species of waterfowl frequent the flooded fields and wooded patches (Mallard, Blue-winged Teal, Wood Duck). A majority of the ducks present in the vicinity, however, used the wetlands designated as Survey Areas 1, 2 and 4. It is likely that relatively greater flooding than experienced in 1980 would attract additional waterfowl to the area, including Whistling Swans (Cygnus olor). This species commonly uses flooded farm fields in river bottoms as foraging sites during spring migration through this part of Wisconsin. Concentrations of swans have used portions of the Pheasant Valley Hunting Club property in recent years (John Burke, pers. communication). In 1980, however, the river did not flood the bottomland until after the peak of swan migration.

The minimal number of species reported on the Project Area (173) represents a reasonably rich avifauna for an area of this size (Project Area about 792 hectares; survey areas 106 hectares). If additional time had been spent searching habitats adjacent to the wetlands for woodland or seral community species, the list undoubtedly would be even more extensive. About 40 (23.1%) of the species listed in Table 2-2 were observed but once, whereas the other 133 species were observed on two or more occasions. This latter figure perhaps denotes more accurately the number of species that can be expected within or immediately adjacent to the flooded part of the survey areas on a regular basis.

Data provided in Figure 2-2 indicate that the Des Plaines River wetlands provide an important stopping place for migrating waterfowl, particularly during spring. We know of no comparably good area for this purpose in the remainder of Kenosha County or along the Des Plaines watershed in Wisconsin. The Project Area also has potential as a breeding area for some waterfowl and as a loafing area for males while females incubate or tend broods. The presence of some waterfowl throughout the summer verifies that this important function is served by the area. Without further draining attempts by human residents, the quality of the wetland area for use by waterfowl should improve as a result of permanent water again being present on some of the naturally wet areas. In addition, waterfowl stopping during fall migration find cover and food on the area. During this season, these birds also provide recreation for local hunters who use blinds constructed in or near Survey Areas 1, 4 and 5 or at various places along the river between County Highways ML and C.

Birds Recorded on Survey Areas 1-5

Species lists for each of the five survey areas are presented as Tables 2-3 through 2-7. The largest assemblage of species was obtained for Survey Area 1 (120 species; Table 2-3). Ranking, in descending order of species present, for the other four areas is as follows: Area 2, 93 species (Table 2-4); Area 4, 80 species (Table 2-5); Area 5, 42 species (Table 2-6); and Area 3, 21 species (Table 2-7).

Nineteen species of waterfowl were observed using the survey areas. This is the same number of waterfowl species recorded for the entire Project Area; in other words, no part of the Project Area attracted species of ducks that were not found within the survey areas. Areas 1, 2 and 4 were most attractive to ducks. All three areas were used as loafing or resting places, foraging areas, molting areas, and as nesting sites (Table 2-8). Table 2-9 shows the number of birds, including waterfowl, that were observed per party hour of observation time. In other words, this is the number of individuals of each species that the team of four ornithologists saw per unit time (hour) of expended effort in the field. These data provide a more accurate comparison of the relative abundance of the various species than the absolute number observed per month (Table 2-2). It is apparent (Table 2-9) that the survey areas are used most frequently by waterfowl during fall and spring. Three species (Mallard, Blue-winged Teal and Wood Duck) remain in small numbers throughout the breeding season. Five species (the preceding 3 plus Gadwall and American Wigeon) intensify their use of the area as the summer progresses.

Six species of wading birds (herons and bitterns) frequented the survey areas (Table 2-9). They used the area for foraging, resting and in two instances (Least Bittern and probably Green Heron) for nesting (Table 2-8). Great Blue Herons from the Bristol Township breeding colony (about 120 nests in 1980) consistently used the Project Area for foraging purposes. This species is highly territorial during foraging and consequently considerable space is maintained between feeding birds during the breeding season. For this reason, the number of herons observed at any point in time probably is not indicative of the total number from the colony that actually use the Project Area. The continued success of the Bristol colony is dependent upon foraging areas such as those available on the Project Area. The Project Area is about 9.6 kilometers west of the breeding colony which places it within optimal foraging range for the herons. The abundance and diversity of fishes and amphibians within the Des Plaines wetlands probably contributed to selection and continued use of this particular nesting site by Great Blue Herons. Nesting and foraging locations for this species are declining at an alarming rate in many areas, such as Illinois counties immediately to the south of the Project Area (Ref. 1).

Four members of the family Rallidae (rails, coots and gallinules) were recorded on the survey areas, primarily 1, 2 and 4. These species used the areas for all of their activities, including nesting. Coots were the most abundant member of this group (Tables 2-2 and 2-9). The number of Soras present during spring and summer is considered indicative of good wetland quality.

Migrating Osprey occasionally foraged over the survey areas during spring and fall. This species feeds almost exclusively on fishes and it probably was attracted by the larger species that inhabit the river, canals and ponds. The expanses of open water in the immediate aera probably are inadequate for attracting nesting Osprey but the wetland expanse along the Des Plaines River provides a relatively safe and productive foraging area for migrants. This becomes increasingly important as lakes in Kenosha County become more heavily developed for human recreation. Ospreys are on the Wisconsin Endangered Species List (Table 2-11) and habitat loss has contributed to their population decline to the point of endangerment.

Long-billed Marsh Wrens (Table 2-9) were abundant on the survey areas. This species was a frequent nester and remained in the Project Area until at least mid-November. Long-billed Marsh Wrens prefer cattail stands for nesting but occasionally use bulrushes or reeds. The prevalence of this species is an indication that existing wetland characteristics (food and cover) are suitable for other marsh birds as well.

Table 2-9 includes 147 species that were observed on the survey areas, or 85.0% of the 173 species that were reported for the entire Project Area. This in part reflects the amount of survey time that was devoted to these areas but, in addition, it indicates the importance of these areas as bird habitat. The areas include open deep pools and ponds with submerged vegetation, deep water marshes with emergent vegetation, shallow expanses with emergents, wet sedge and grass meadows, scrub-brush areas adjacent to or within flooded areas, and upland borders with grass, brush or deciduous woods. The assortment of habitats provided by such a combination of physical and biotic factors results in high avian species diversity such as depicted in Table 2-2.

Typical Wetland Species Nesting on Survey Areas

The flooded wetlands in Survey Areas 1, 2 and 4 were systematically searched for nests on a weekly basis from 28 May through 16 July 1980. In all, 399 nests were located; 62 on Survey Area 1, 223 on Survey Area 2, and 114 on Survey Area 4 (Table 2-10). The nests of 13 species were identified on the basis of egg characteristics or as a result of the adult occupant being observed. A sizeable proportion (93.5%) of the 185 Long-billed Marsh Wren nests were 'dummy' nests. Males of this polygamous species build extra nests as part of their effort to attract females and to discourage other males from invading their territory. Dominant males and those that ultimately attract the largest number of females have the highest number of dummy nests (19 or so per male). We located 12 nests of this species that contained eggs or young.

The tendency for Pied-billed Grebes, Least Bitterns, Soras, Virginia Rails, Black Terns and Yellow-headed Blackbirds to nest in the Survey Areas indicates that the quality of the wetland is relatively good. These species have diverse foraging habits and exploit a variety of food items. Their requirements apparently are satisfied by the wetland complex contained in the survey areas. The nesting habits of each species are quite specific and the heterogeneity of the wetland vegetation, the mosaic arrangement of open water and vegetation, and the abundance of food types are all essential to their occurrence.

Only two duck nests were located (Table 2-10). This is not surprising as the three species recorded on the areas during the breeding season usually do not nest in the flooded parts of marshes. Since we did not search upland meadows, fringe areas of grass or sedges, or woodland sites for Wood Duck nesting cavities, the number of duck nests located must be viewed as the absolute minimum number present on the Project Area in 1980. The vegetated wetlands seem to provide optimal foraging habitat and cover for female ducks and their broods, good loafing areas for males and adequate cover for molting ducks. Its potential as a duck breeding area appears high, particularly when compared with other localities in Kenosha County.

Threatened and Endangered Species on the Project Area

Table 2-11 lists the threatened and endangered bird species for the State of Wisconsin. Two endangered and three threatened species were recorded on the Project Area. Osprey and Common Tern (endangered) both foraged on the survey sites. The area is not considered as optimal foraging or breeding habitat for the Common Tern although individuals migrating or nesting along the Lake Michigan shoreline might visit occasionally. Ospreys, on the other hand, may find the area valuable for foraging purposes during migration. The amount of open water probably is insufficient to attract breeding Ospreys. This wetland area could provide nesting habitat for the endangered Forster's Tern (Sterna forsterii) if water levels are permitted to remain at or near present levels. None were observed, however, during any of our visits in 1979 or 1980.

The Great Egret (threatened) was observed on one occasion within the Project Area. This species might possibly nest in the Bristol Township heronry but none were observed by us or by Carl Becker (Coordinator, Illinois Endangered Species Program, pers. communication), during visits in May and June 1980. The river and marsh habitats could provide valuable foraging habitat for this species during migration or during the breeding season if any occur in Bristol Township. Great Egrets that nest in a colony at Horicon National Wildlife Refuge probably pass through this area during migration. Loss of foraging areas is one factor limiting the distribution of Great Egrets in the Midwest.

The Cooper's Hawk (threatened) was observed on five occasions (Table 2-2) near Survey Areas 1 and 2. This woodland species may nest on the Project Area but we have no data to support this speculation. The abundance of birds and other potential prey on the Project Area make it optimal habitat for the Cooper's Hawk during migration and during the nesting season.

The Red-shouldered Hawk (threatened) was observed on two occasions. This species prefers riparian woodlands such as those along the Des Plaines River within the Project Area. We did not document nesting on the area but suitable habitat seems to exist.

The effect of drainage, dredging and development on wildlife using wetland habitats is evidenced by the number of wetland species included on the Illinois Threatened and Endangered Species list (Table 2-12). Twenty of the species on the Illinois list (those checked in Table 2-12) are dependent upon wetland habitats for foraging, nesting or both. The destruction of marshes, floodplain habitat and other wetlands, particularly in northeastern Illinois, have contributed significantly to the present jeopardy of these species (Ref. 1). Several of the species on the Illinois list either nested on the Project Area or were observed during migration. Continued wetland destruction in areas adjoining Illinois, such as Kenosha County, will enlarge the geographic area in which these species are severely stressed thereby increasing the probability of their extinction in this part of the Great Lakes Region.

EVALUATION OF HABITAT QUALITY FOR WETLAND BIRDS

Evaluation Indices Based on Breeding Birds

Determination of the importance or environmental value of particular pieces of property has been approached in a variety of ways. The fundamental value of the natural environment usually is expressed in terms of its value as habitat for wildlife, frequently described on the basis of vegetative characteristics. It is important that a standardized evaluation method be adopted for application where impact analysis is involved. Graber and Graber (Ref. 2) developed a method based upon: 1) the "cost" of each habitat, specifically its replacement cost as measured in time; 2) the availability of each habitat, as indicated by its total area in the state or region of the state; 3) the changing availability (if changing) of each habitat; 4) the amount of each habitat in the impact area; and 5) the faunal and/or floral complexity of each habitat. These factors are used in calculating indices to environmental value by converting them to numerical values that reflect natural parameters of habitats (Ref. 2). The resulting numerical values then are used in simple equations to determing three indices of environmental value -- the Habitat Evaluation Index, the Average Species Index and the Faunal Index.

We have used this approach in making an objective determination of the value of the Des Plaines River wetland in Kenosha County as bird habitat. Graber and Graber (Ref. 2) provided background information necessary for applying this method in evaluating marshes in northern Illinois. Since the Project Area is located immediately north of the Illinois-Wisconsin border, use of this procedure and their baseline data for Illinois appears justified.

The components of this evaluation procedure will be described briefly. Further details can be obtained from the original source (Ref. 2). Replacement Cost of the Habitat is defined as the time required to re-establish a particular biocommunity. Two categories of marshes are recognized from the replacement standpoint -- natural marshes and manmade marshes. Natural marshes have a long evolution and development because the underwater soil, which creates conditions suitable for specific types of vegetative growth, requires many years to accumulate. Manmade marshes develop more rapidly, have simpler plant communities and usually support few of the characteristic marsh birds. The span of time required for replacement of these types of marshes ranges from 3-100 years, with manmade types being at the lower extreme and natural types at the opposite extreme. For the purpose of evaluating the Des Plaines River wetlands, I arbitrarily selected 25 years as the approximate replacement time necessary to duplicate some of the types of conditions currently found in the survey areas.

Habitat Availability refers to the acreage of a particular gross habitat in a specified geographical area. After replacement cost, this is considered the next most important factor in the evaluation. Since data on wetland acreage in southeastern Wisconsin were not readily available, I used data for northern Illinois. In this area, 31,700 acres of marshes occur (Ref. 2). This figure is probably higher than the actual amount of wetland present in Kenosha County and the immediately adjacent counties. Use of this figure, therefore, tends to deflate rather than inflate the evaluation results for the Project Area. Changing Availability of Habitats refers to the rate at which regional acreage of a given habitat has increased or decreased during the most recent decade for which data are available. It is an additive or subtractive modifier to the Availability Factor. The figures for northern Illinois (Ref. 2) and the southern tier of Wisconsin counties (if available) probably would be similar.

The Acreage Factor is an index of the amount of a given habitat in an area of concern or impact area. This is expressed as a percentage obtained by dividing the number of acres of a habitat by the number of acres in the impact area. The Acreage Factor is used as a multiplier in the computation of the Habitat Factor (Ref. 2).

The Faunal Index consists of a sum of numerical values assigned to the nesting species of birds that occupy a given area of habitat (Ref. 2). The numerical values are based on the state population of each species and the extent to which each species is specialized toward use of a single gross habitat. The relationship between any organism and its habitat is always specialized, but there are differing degrees of specialization, with some species being more dependent upon a particular habitat than others. Black Terns, for example, require a certain type of marsh whereas Gray Catbirds nest in a variety of situations. The point system reflects these differences. For this purpose, I used point values from a list prepared by Graber and Graber (Ref. 2). Species for which nests were found on Survey Areas 1, 2 and 4 were used in calculating the Faunal Index for the

Project Area. Although Graber and Graber (Ref. 2) indicated that occurrence data (repeated observations on a site) during summer is adequate evidence of breeding for this purpose, I opted to use only those species for which nests were actually recorded in 1980. As a result, the Faunal Index calculated for the survey areas in a minimal value. The Faunal Index is calculated by dividing the sum of the species values by the common logarithm of the number of acres of a particular habitat on the area.

The Average Species Index is calculated by dividing the number of species for which nesting data exist into the sum of points assigned to each species (i.e. sum = Total Species Points). The richer the habitat in both common and rare species, the higher the Average Species Index value. For a given acreage of habitat, both the Total Species Points and Average Species Index reflect the quality of the habitat (Ref. 2). A tract that supports only a few of the most common and tolerant species is less valuable biologically than a tract that supports a large variety of common and rare species.

The calculated values for the survey areas are presented in Table 2-13 and compared with expected values (Fig. 2-2) derived by Graber and Graber (Ref. 2). Since the values for the survey areas are well above the expected values on the graph, the habitat is considered as superior in faunal quality and should be given extra consideration in any actions that might impact the area.

The Faunal Index takes into account the acreage of the habitat and the Total Species Points without direct reference to the number of species. The Faunal Index is obtained from Figure 2-2 by using the acreage at the bottom of the graph. Using this method, the value for Survey Areas 1, 2 and 4 combined is 630.65 (Table 2-13). This figure is somewhat below the predicted value for an area of this size. This means that the combined area is not of superior quality according to this procedure but yet it probably falls into the good range. It must be recognized that the indices are indicative only of the present (1980) condition of the wetland habitats, not of their future potential. It is likely that the present breeding avifauna of the area reflects the extent to which past manipulation of water levels has influenced habitat quality. With continuing conditions similar to those in 1980, marsh quality should improve as will conditions for most of the marsh nesting species. These indices only reflect wetland quality (biological value) as based on breeding species of birds rather than the complete assemblage of species that use the wetland seasonally during migration or use it for other than breeding purposes. As conclusively shown in this report, numerous individuals representing a variety of avian species use the Project Area on a seasonal basis. The importance of the area for these combined uses, nesting and seasonal (migratory) use, is significantly greater than its value for any single purpose.

The Habitat Evaluation Index (HEI) provides a means of evaluating the richness (potential value) of survey area habitats as compared to the average for the region. This procedure, as described by Graber and Graber (Ref. 2) produces a HEI of 2.25 for the survey areas when compared with the entire Project Area and 10.66 if only comparable deep-water marshes (hemimarshes) are considered. This means that richness of the habitats evaluated is 2.25 to 10.66 times above the average for the region. Reduction of the replacement time from 25 to 12 years (represents a reduction in ecological complexity) results in a HEI of 1.07, which is still slightly above average (average HEI = 1.00). Characteristics of the flooded marshes (about 400 acres) are good enough that further lowering of the estimated replacement time to three years (minimum for manmade areas) results in a HEI of 1.28, which is also above average.

These procedures indicate that the habitat and faunal characteristics of the Project Area, including the breeding marsh birds, are such that the area should be ranked from good to outstanding.

Habitat Evaluation Based on Waterfowl Requirements

On four occasions during the project (fall, spring, summer, fall), each member of the ornithological team prepared an evaluation of waterfowl habitat found on the Project Area. The procedure followed was that of Flood et al. (Ref. 3) in which various habitat characteristics are scored, weighted and then a mean value established. Table 2-14 shows the type of factors that were considered and gives our mean scores for Fall 1979. Because water levels were higher in 1980, the average scores ranged slightly higher (8.01).

On this basis, the Project Area appears to provide good habitat (average = 5.0) for waterfowl (a ranking between average and superior). This conclusion is substantiated by the number and variety of ducks that used the Project Area during 1979-80 (Table 2-2).

The two procedures described above plus the documentation of bird occurrence on the area, singly or in combination, indicate that the Project Area represents good to very good habitat for waterfowl, marsh birds and allied species. The value of the area is even greater than these procedures indicate, since the Project Area is the last remaining expanse of wetland in southeastern Wisconsin.

REFERENCES CITED IN PART 2

1. Graber, J. W., R. R. Graber and E. L. Kirk. 1978. Illinois Birds: Ciconiiformes. Ill. Nat. Hist. Survey, Biol. Notes No. 109, Urbana, Ill. 80p.

2. Graber, J. W. and R. R. Graber. 1976. Environmental evalualations using birds and their habitats. Ill. Nat. Hist. Survey, Biol. Notes No. 97. Urbana, Ill. 39p.

3. Flood, B. S., M. E. Sangser, R. D. Sparrowe and T. S. Baskett. 1977. A handbook for habitat evaluation procedures. U.S. Fish and Wildlife Service Resource Publ. 139.

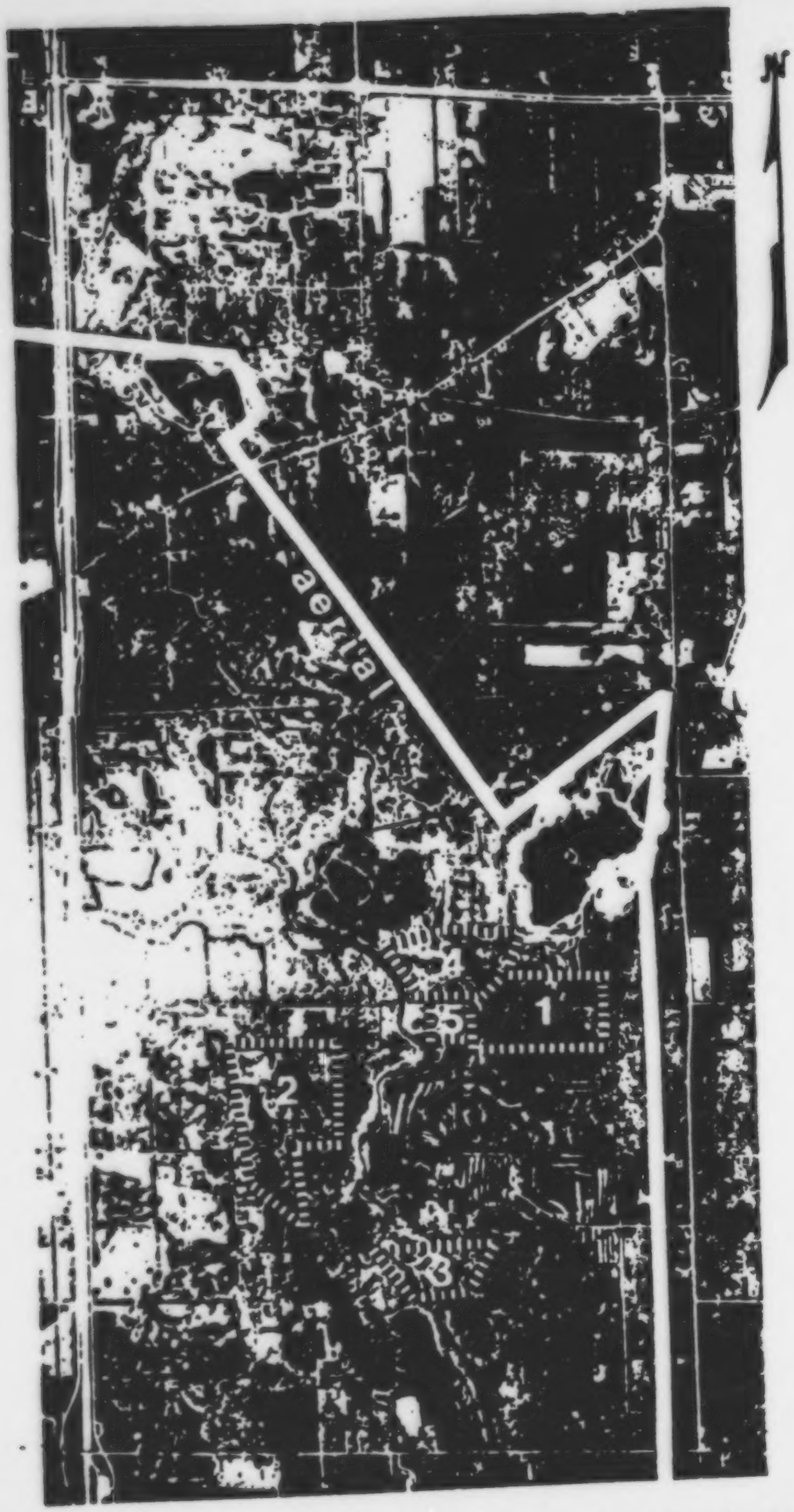

Figure 2-1. Location of Bird Survey Areas 1-5 (enclosed by broken lines). The area west of the solid line was covered during aerial surveys.

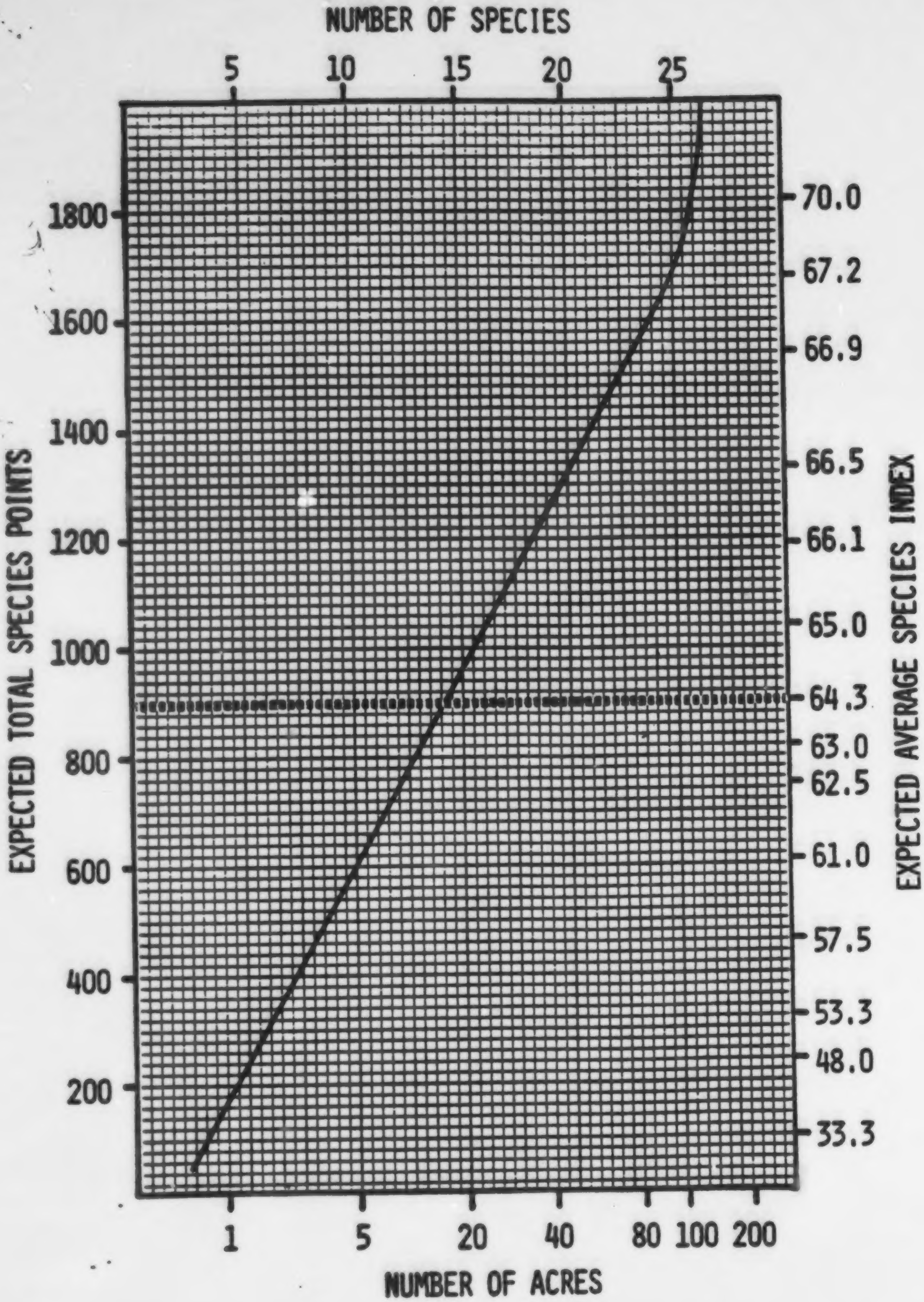

Figure 2-2. Relationship of numbers of species and their assigned index values to acreage censused in marsh habitat. The black graph line is used to interpret calculated Faunal Indices in vevaluating impact areas. The black and white line extends between values for the Project Area. From Ref. 2.

Table 2-1. Dates spent in the Project Area to conduct bird surveys.

1979	1980	
19 October	26 March	18 June
21 October	4 April	25 June
2 November	9 April	2 July
9 November	18 April	9 July
17 November	19 April	16 July
	25 April	6 August
	26 April	29 August
	2 May	5 September
	3 May	12 September
	8 May	19 September
	9 May	27 September
	15 May	3 October
	16 May	8 October
	27 May	17 October
	28 May	22 October
	3 June	31 October
	4 June	7 November
	11 June	14 November
	12 June	
5 days 20 man-days	37 days 148 man-days	
42 days 168 man-days		

Table 2-2. Total individuals observed per month (transects, aerial and composite surveys combined) within the Project Area.

	1979		1980								
	OCT	NOV	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
GAVIIDAE											
Common Loon				1							
PODICIPEDIDAE											
Horned Grebe									2		
Pied-billed Grebe	11	9		8	6	6	2	3	22	24	6
ARDEIDAE											
Great Blue Heron	7	6	2	50	59	28	27	23	48	4	
Great Egret						1					
Green Heron				3	34	37	39	47	43	5	
Black-crowned Night Heron				1	2			2	2		
Yellow-crowned Night Heron								1?			
American Bittern		1								5	
Least Bittern					4	24	12	12	1		
ANATIDAE											
Canada Goose	4			39	15				9	53	
Mallard	133	153	56	1392	241	97	46		106	328	34
Black Duck	2	1	2	68	4					4	
Gadwall		1		55	4				3	6	1
Pintail	4	7		20	3					14	
Green-winged Teal	15	48		178	11		1			28	
Blue-winged Teal	7	11	12	1445	700	57	41	170	276	161	
American Wigeon	1	116	15	490	47			3	40	58	2
Northern Shoveler			2	115	18				2	20	2
Wood Duck	7		5	151	30	137	55	112	227	74	1
Redhead				10							
Ring-necked Duck			9	346							
Canvasback				4						1	
Lesser Scaup				33						12	
Common Goldeneye			2		1						
Bufflehead				49	2						
Ducks spp.		28		1182						14	
Ruddy Duck										1	
Hooded Merganser		11	4	8						1	
Red-breasted Merganser				27							
ACCIPITRIDAE											
Sharp-shinned Hawk				2					4	2	
Cooper's Hawk	2			1			1		1	1	
Red-tailed Hawk	11	5	1	21	11	8	3	2	14	14	3
Red-shouldered Hawk				2	4						
Broad-winged Hawk				1	1			1		1	
Rough-legged Hawk				1							
Marsh Hawk	1	4		2				1	3	3	1

Table 2-2 cont.

	1979		1980								
	OCT	NOV	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PANDIONIDAE											
Osprey				2					2		
FALCONIDAE											
American Kestrel	1	2	2	6	3		1	3	4	3	2
PHASIANIDAE											
Ring-necked Pheasant	13	5						5			1
Gray Partridge											2
RALLIDAE											
Virginia Rail				2	2			1		1	
Sora	6	2		33	153	20	1	18	36	1	
Common Gallinule				2	4	1		4	11	1	
American Coot	239	145	1	1931	426	94	46	50	1031	2651	43
CHARADRIIDAE											
Killdeer	6	5	3	22	21	18	10	11	32	26	
American Golden Plover					25					39	
SCOLOPACIDAE											
Common Snipe	150	100		46	19	4		1	15	74	3
Upland Sandpiper							4				
Spotted Sandpiper					20	8	10	3			
Greater Yellowlegs	5	2		8	1			3	14	8	
Lesser Yellowlegs	2			53	7			8	2	7	
Pectoral Sandpiper		10		80	40				14	1	
Shorebird spp.										25	
Dowitcher										1	
LARIDAE											
Herring Gull	3	363	5	32				12	7	17	
Ring-billed Gull	45	144	3	198	17			43	543	137	
Gull spp.			10	3				1	86	6	
Bonaparte's Gull				25							
Common Tern										2	
Black Tern					7	13	14				
COLUMBIDAE											
Mourning Dove	4	3		32	24	5	11	32	121	33	6
Rock Dove				2	5	6	7	9	3	15	20
CUCULIDAE											
Yellow-billed Cuckoo					3		3		2		
Black-billed Cuckoo					1	1	1	1	1	1	
STRIGIDAE											
Great Horned Owl									1		
CAPRIMULGIDAE											
Common Nighthawk					2						
APODIDAE											
Chimney Swift				5	135		13	1	88	27	

Table 2-2 cont.

	1979		1980								
	OCT	NOV	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
TROCHILIDAE											
Ruby-throated Hummingbird									1		
ALCEDINIDAE											
Belted Kingfisher	3			10	8	3		10	11	9	
PICIDAE											
Common Flicker	1			39	11	9	5	10	18	2	
Red-bellied Woodpecker				2						3	
Red-headed Woodpecker					2		1		2	1	
Yellow-bellied Sapsucker					1						
Hairy Woodpecker	1	9							1		
Downy Woodpecker	1	4		3	9	1		1	1	7	6
TYRANNIDAE											
Eastern Kingbird			1		12	10	9	4	2		
Great Crested Flycatcher					5	8	3	1			
Eastern Phoebe			1	1	1				2		
Yellow-bellied Flycatcher									1		
Alder Flycatcher					3						
Willow Flycatcher					1	6	1		1		
Least Flycatcher					1	1					
Eastern Wood Pewee					1	1	3	1			
ALAUDIDAE											
Horned Lark				5	1						
HIRUNDINIDAE											
Tree Swallow			1	351	222	60	7	8	427	1	
Bank Swallow				4	238	131	63	10	27		
Rough-winged Swallow				13	28	5					
Barn Swallow	2			90	201	38	58	114			
Cliff Swallow								1	1		
Purple Martin				32	21	6		9	11		
CORVIDAE											
Blue Jay	7	10	1	7	30	7	9	6	116	15	6
Common Crow	32	32	11	24	16	3	4	15	95	26	26
PARIDAE											
Black-capped Chickadee	14	21	11	14	13	3	7	17	10	24	9
SITTIDAE											
White-breasted Nuthatch					1				1		1
Red-breasted Nuthatch										1	
CERTHIIDAE											
Brown Creeper	2										
TROGLODYTIDAE											
House Wren					4	2	2	1	3		
Long-billed Marsh Wren	6				185	306	277	201	260	133	3
Short-billed Marsh Wren					4		2	1			

Table 2-2 cont.

	1979		1980								
	OCT	NOV	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
MIMIDAE											
Gray Catbird					3	5	1	2	2		
Brown Thrasher				3	8	7	5	1	3		
TURDIDAE											
American Robin	109	21	19	120	51	30	40	32	237	131	2
Wood Thrush				1	4	4	1				
Hermit Thrush	1									2	
Swainson's Thrush									4	1	
Veery									2		
Eastern Bluebird										1	
SYLVIIDAE											
Blue-gray Gnatcatcher					3						
Golden-crowned Kinglet	1	3		12	2					2	
Ruby-crowned Kinglet	3			6						7	
MOTACILLIDAE											
Water Pipit									1	1	
BOMBYCILLIDAE											
Cedar Waxwing				22	2	1	10	22	16		
LANIIDAE											
Northern Shrike			1								
STURNIDAE											
Starling	69	16	9	102	4		1	20	295	141	39
VIREONIDAE											
Red-eyed Vireo					1	1					
Warbling Vireo					1						
PARULIDAE											
Black-and-white Warbler					3				1		
Golden-winged Warbler					1						
Blue-winged Warbler					1						
Tennessee Warbler					2				5		
Orange-crowned Warbler					1				1		
Nashville Warbler					3						
Northern Parula											
Yellow Warbler					39	5					
Magnolia Warbler					13						
Cape May Warbler									1		
Yellow-rumped Warbler	58	2		24	28				84	59	
Black-throated Green Warbler					2				2		
Chestnut-sided Warbler					3						
Bay-breasted Warbler					1				1		
Blackpoll Warbler									2		
Pine Warbler									1	1	
Palm Warbler	1				32					1	

Table 2-2 cont.

	1979		1980								
	OCT	NOV	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
Ovenbird					1						
Northern Waterthrush	1				2				2		
Mourning Warbler					2						
Common Yellowthroat	1				88	30	51	17	26	5	
Wilson's Warbler					4				2		
American Redstart					3				9		
LOCEIDAE											
House Sparrow	11				5	5	20	13	6	2	
ICTERIDAE											
Bobolink					6	5	10	1	3		
Eastern Meadowlark	1			13	11			3	9	3	
Western Meadowlark										1	
Yellow-headed Blackbird			1	2	54	108	86	21	11	1	
Red-winged Blackbird	329	823	818	1894	1196	807	620	449	1949	9018	952
Northern Oriole					13	5	1	1			
Rusty Blackbird	16	124	76	10						198	
Brewer's Blackbird	3			2							
Common Grackle	94	12	53	350	145	67	41	8	154	229	
Brown-headed Cowbird		35	15	54	58		2	1	69	20	
THRAUPIDAE											
Scarlet Tanager					1						
FRINGILLIDAE											
Cardinal	2	7	4	13	12	4	3	2		3	2
Rose-breasted Grosbeak					8	1		1	11		
Indigo Bunting					2	15	18	7	2	1	
Dickcissel						1	2				
Purple Finch				1						4	
Pine Siskin				1							
American Goldfinch	2	8	1	1	10	6	25	19	23	19	2
Rufous-sided Towhee	2				1		1				
Savannah Sparrow	2			2	6	5	2			5	
Grasshopper Sparrow						4	5	1			
Sharp-tailed Sparrow									7		
Vesper Sparrow	1			1	2		1		1	32	
Dark-eyed Junco	16	59	4	2						68	41
Tree Sparrow		63	11	30	2						15
Chipping Sparrow					3	1					
Field Sparrow				1		2					
White-crowned Sparrow	11										6
White-throated Sparrow	67	68			3				1	19	10
Fox Sparrow	14	17		1						4	5
Lincoln's Sparrow	1										
Swamp Sparrow	211	17		121	248	87	80	44	52	255	35
Song Sparrow	13	23	25	83	78	13	26	12	15	22	8
Lapland Longspur		2								2	

TOTAL: 173 species

Table 2-3. Avian species recorded in Survey Area 1, 1979-80.

Common Loon
Pied-billed Grebe
Great Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Least Bittern
Canada Goose
Mallard
Black Duck
Gadwall
Pintail
Green-winged Teal
Blue-winged Teal
American Wigeon
Northern Shoveler
Wood Duck
Redhead
Ring-necked Duck
Lesser Scaup
Common Goldeneye
Bufflehead
Duck spp.
Hooded Merganser
Sharp-shinned Hawk
Red-tailed Hawk
Red-shouldered Hawk
Rough-legged Hawk
Marsh Hawk
Osprey
American Kestrel
Ring-necked Pheasant
Sora
Common Gallinule
American Coot
Killdeer
Common Snipe
Spotted Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
Pectoral Sandpiper
Dowitcher
Herring Gull
Ring-billed Gull
Gull spp.
Common Tern
Black Tern
Mourning Dove
Rock Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Common Nighthawk
Chimney Swift
Belted Kingfisher
Common Flicker
Red-bellied Woodpecker
Red-headed Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher
Eastern Phoebe
Eastern Wood Pewee
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin
Blue Jay
Common Crow
Black-capped Chickadee
Red-breasted Nuthatch
Long-billed Marsh Wren
Short-billed Marsh Wren
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Swainson's Thrush
Eastern Bluebird
Golden-crowned Kinglet
Ruby-crowned Kinglet
Water Pipit
Cedar Waxwing
Starling
Red-eyed Vireo
Warbling Vireo
Black-and-white Warbler
Tennessee Warbler
Yellow Warbler
Magnolia Warbler
Yellow-rumped Warbler
Black-throated Green Warbler
Blackpoll Warbler
Pine Warbler
Palm Warbler
Northern Waterthrush
Common Yellowthroat
Wilson's Warbler
American Redstart

Table 2-3 cont.

Bobolink
Eastern Meadowlark
Yellow-headed Blackbird
Red-winged Blackbird
Northern Oriole
Rusty Blackbird
Brewer's Blackbird
Common Grackle
Brown-headed Cowbird
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
American Goldfinch
Dark-eyed Junco
Tree Sparrow
Chipping Sparrow
White-crowned Sparrow
White-throated Sparrow
Lincoln's Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur

TOTAL: 120 species

Table 2-4. Avian species recorded in Survey Area 2, 1979-80.

Pied-billed Grebe
Great Blue Heron
Green Heron
Black-crowned Night Heron
Least Bittern
Canada Goose
Mallard
Black Duck
Gadwall
Pintail
Green-winged Teal
Blue-winged Teal
American Wigeon
Northern Shoveler
Wood Duck
Redhead
Ring-necked Duck
Lesser Scaup
Bufflehead
Duck spp.
Ruddy Duck
Hooded Merganser
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Broad-winged Hawk
Marsh Hawk
Osprey
American Kestrel
Virginia Rail
Sora
Common Gallinule
American Coot
Killdeer
Common Snipe
Spotted Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
Pectoral Sandpiper
Herring Gull
Ring-billed Gull
Gull spp.
Black Tern
Mourning Dove
Rock Dove
Black-billed Cuckoo
Chimney Swift
Belted Kingfisher
Common Flicker
Red-headed Woodpecker
Hairy Woodpecker
Downy Woodpecker
Eastern Phoebe
Willow Flycatcher
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin
Blue Jay
Common Crow
Black-capped Chickadee
Long-billed Marsh Wren
Short-billed Marsh Wren
Brown Thrasher
American Robin
Wood Thrush
Veery
Cedar Waxwing
Northern Shrike
Starling
Yellow Warbler
Yellow-rumped Warbler
Palm Warbler
Northern Waterthrush
Common Yellowthroat
Bobolink
Yellow-headed Blackbird
Red-winged Blackbird
Northern Oriole
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Cardinal
Rose-breasted Grosbeak
Pine Siskin
American Goldfinch
Sharp-tailed Sparrow
Vesper Sparrow
Tree Sparrow
White-throated Sparrow
Fox Sparrow
Swamp Sparrow
Song Sparrow

TOTAL: 93 species

Table 2-5. Avian species recorded in Survey Area 4, 1979-80.

Horned Grebe
Pied-billed Grebe
Great Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Least Bittern
Canada Goose
Mallard
Black Duck
Gadwall
Pintail
Green-winged Teal
Blue-winged Teal
American Wigeon
Northern Shoveler
Wood Duck
Ring-necked Duck
Lesser Scaup
Bufflehead
Hooded Merganser
Red-tailed Hawk
Marsh Hawk
Ring-necked Pheasant
Virginia Rail
Sora
Common Gallinule
American Coot
Killdeer
Common Snipe
Spotted Sandpiper
Shorebird spp.
Greater Yellowlegs
Lesser Yellowlegs
Pectoral Sandpiper
Herring Gull
Ring-gilled Gull
Black Tern
Mourning Dove
Rock Dove
Chimney Swift
Belted Kingfisher
Common Flicker
Eastern Kingbird
Eastern Phoebe
Willow Flycatcher
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Purple Martin
Blue Jay
Common Crow
House Wren
Long-billed Marsh Wren
Short-billed Marsh Wren
Gray Catbird
Brown Thrasher
American Robin
Water Pipit
Cedar Waxwing
Yellow Warbler
Yellow-rumped Warbler
Common Yellowthroat
Bobolink
Western Meadowlark
Yellow-headed Blackbird
Red-winged Blackbird
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Rose-breasted Grosbeak
Indigo Bunting
Dickcissel
American Goldfinch
Savannah Sparrow
Vesper Sparrow
Tree Sparrow
Swamp Sparrow
Song Sparrow

TOTAL: 80 species

Table 2-6. Avian species recorded in Survey Area 5, 1979-80.

Great Blue Heron
Green Heron
Least Bittern
Mallard
Blue-winged Teal
American Wigeon
Northern Shoveler
Wood Duck
Red-tailed Hawk
Sora
Common Snipe
Spotted Sandpiper
Ring-billed Gull
Chimney Swift
Belted Kingfisher
Tree Swallow
Bank Swallow
Barn Swallow
Blue Jay
Common Crow
Black-capped Chickadee
Long-billed Marsh Wren
American Robin
Ruby-crowned Kinglet
Cedar Waxwing
Yellow Warbler
Palm Warbler
Common Yellowthroat
Wilson's Warbler
Bobolink
Eastern Meadowlark
Red-winged Blackbird
Northern Oriole
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Indigo Bunting
American Goldfinch
Dark-eyed Junco
Tree Sparrow
Swamp Sparrow
Song Sparrow

TOTAL: 42 species

Table 2-7. Avian species recorded in Survey Area 3, 1979-80.

Great Blue Heron
Mallard
Pintail
Blue-winged Teal
Marsh Hawk
Ring-necked Pheasant
Sora
American Coot
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Black-capped Chickadee
Long-billed Marsh Wren
Red-winged Blackbird
Dark-eyed Junco
Tree Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur

TOTAL: 21 species

Table 2-8. Composite list of all bird species recorded on the Project Area, showing the types of use each species make make of the wetlands, its habitat preference, and its typical seasonal status.

Table 2-8.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Common Loon *Gavia immer*	✓			✓	✓			✓			
Horned Grebe *Podiceps auritus*	✓			✓	✓			✓			
Pied-billed Grebe *Podilymbus podiceps*	✓	✓		✓	✓				✓		
Great Blue Heron *Ardea herodias*	✓		✓	✓	✓	✓			✓		
Great Egret *Casmerodius albus*	✓		✓	✓	✓				✓		
Green Heron *Butorides virescens*	✓		✓	✓	✓	✓	✓		✓		
Black-crowned Night Heron *Nycticorax nycticorax*	✓		✓	✓	✓	✓			✓		
Yellow-crowned Night Heron *Nyctanassa violacea*	✓			✓	✓	✓		✓			
American Bittern *Botaurus lentiginosus*	✓		✓	✓	✓	✓			✓		
Least Bittern *Ixobrychus exilis*	✓	✓		✓	✓				✓		
Canada Goose *Branta canadensis*	✓			✓	✓	✓		✓			
Mallard *Anas platrhynchos*	✓	✓		✓	✓	✓			✓		
Black Duck *Anas rubripes*	✓		✓	✓	✓			✓			
Gadwall *Anas strepera*	✓			✓	✓			✓			
Pintail *Anas acuta*	✓			✓	✓			✓			

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Green-winged Teal *Anas carolinensis*	✓			✓	✓			✓			
Blue-winged Teal *Anas discors*	✓	✓		✓	✓	✓			✓		
American Wigeon *Anas americana*	✓			✓	✓			✓	✓		
Northern Shoveler *Spatula clypeata*	✓		✓	✓	✓			✓			
Wood Duck *Aix sponsa*	✓		✓	✓	✓		✓		✓		
Redhead *Aythya americana*	✓			✓	✓			✓			
Ring-necked Duck *Aythya collaris*	✓			✓	✓			✓			
Canvasback *Aythya valisineria*	✓			✓	✓			✓			
Lesser Scaup *Aythya affinis*	✓			✓	✓			✓			
Common Goldeneye *Bucephala Clangula*	✓			✓	✓			✓			
Bufflehead *Bucephala albeola*	✓			✓	✓			✓			
Ruddy Duck *Oxyura jamaicensis*	✓		✓	✓	✓			✓			
Hooded Merganser *Lophodytes cucullatus*	✓		✓	✓	✓			✓			
Red-breasted Merganser *Mergus serrator*	✓			✓	✓			✓			

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Sharp-shinned Hawk *Accipiter striatus*	✓		✓	✓		✓	✓	✓	✓		
Cooper's Hawk *Accipiter cooperii*	✓		✓	✓		✓	✓	✓	✓		
Red-tailed Hawk *Buteo jamaicensis*	✓		✓			✓	✓	✓			✓
Red-shouldered Hawk *Buteo lineatus*	✓		✓			✓	✓	✓	✓		
Broad-winged Hawk *Buteo platypterus*	✓		✓				✓	✓	✓		
Rough-legged Hawk *Buteo lagopus*	✓			✓	✓	✓		✓		✓	
Marsh Hawk *Circus cyaneus*	✓		✓	✓	✓	✓		✓	✓		
Osprey *Pandion haliaetus*	✓			✓	✓			✓			
American Kestrel *Falco sparverius*	✓		✓	✓		✓			✓		✓
Ring-necked Pheasant *Phasianus colchicus*	✓		✓			✓					✓
Gray Partridge *Perdix perdix*	✓		✓			✓					✓
Virginia Rail *Rallus limicola*	✓	✓		✓	✓	✓			✓		
Sora *Porzana carolina*	✓	✓		✓	✓				✓		
Common Gallinule *Gallinula chloropus*	✓	✓		✓	✓				✓		
American Coot *Fulica americana*	✓	✓		✓	✓				✓		

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Killdeer *Charadrius vociferus*	✓		✓	✓		✓			✓		
American Golden Plover *Pluvialis dominica*	✓					✓		✓			
Common Snipe *Capella gallinago*	✓		✓	✓	✓	✓		✓	✓		
Upland Sandpiper *Bartramia longicauda*	✓			✓		✓		✓			
Spotted Sandpiper *Actitis macularia*	✓		✓	✓	✓	✓			✓		
Greater Yellowlegs *Totanus melanoleucus*	✓			✓	✓			✓			
Lesser Yellowlegs *Totanus flavipes*	✓			✓	✓			✓			
Pectoral Sandpiper *Erolia melanotos*	✓				✓			✓			
Dowitcher *Limnodromus* sp.	✓				✓			✓			
Herring Gull *Larus argentatus*	✓			✓	✓			✓			
Ring-billed Gull *Larus delawarensis*	✓			✓	✓			✓			
Bonaparte's Gull *Larus philadelphia*	✓			✓	✓			✓			
Common Tern *Sterna hirundo*	✓			✓	✓			✓			
Black Tern *Chlidonias niger*	✓	✓		✓	✓				✓		

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Mourning Dove *Zenaidura macroura*	✓		✓	✓		✓	✓		✓		✓
Rock Dove *Columba livia*	✓					✓					✓
Yellow-billed Cuckoo *Coccyzus americanus*	✓			✓		✓	✓		✓		
Black-billed Cuckoo *Coccyzus erythropthalmus*	✓			✓		✓	✓		✓		
Great Horned Owl *Bubo virginianus*	✓		✓	✓		✓	✓				✓
Common Nighthawk *Chordeiles minor*	✓		✓						✓		
Chimney Swift *Chaetura pelagica*	✓							✓	✓		
Ruby-throated Hummingbird *Archilochus colubris*	✓		✓						✓		
Belted Kingfisher *Megaceryle alcyon*	✓		✓	✓	✓				✓		
Common Flicker *Colaptes auratus*	✓		✓	✓			✓		✓		
Red-bellied Woodpecker *Centurus carolinus*	✓		✓	✓			✓		✓		
Red-headed Woodpecker *Melanerpes erythrocephalus*	✓		✓	✓			✓		✓		
Yellow-bellied Sapsucker *Sphyrapicus varius*	✓		✓	✓			✓		✓		
Hairy Woodpecker *Dendrocopos villosus*	✓			✓			✓	✓			
Downy Woodpecker *Dendrocopos pubescens*	✓		✓	✓			✓	✓			

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Eastern Kingbird *Tyrannus tyrannus*	✓		✓	✓	✓	✓			✓		
Great Crested Flycatcher *Myiarchus crinitus*	✓		✓	✓			✓		✓		
Eastern Phoebe *Sayornis phoebe*	✓		✓	✓	✓				✓		
Yellow-bellied Flycatcher *Empidonax flaviventris*	✓			✓		✓		✓			
Alder Flycatcher *Empidonax alnorum*	✓			✓		✓		✓			
Willow Flycatcher *Empidonax trailii*	✓		✓	✓		✓			✓		
Least Flycatcher *Empidonax minimus*	✓		✓	✓			✓		✓		
Eastern Wood Pewee *Contopus virens*	✓		✓	✓			✓		✓		
Horned Lark *Eremophila alpestris*	✓		✓	✓		✓			✓		
Tree Swallow *Iridoprocne bicolor*	✓		✓	✓	✓	✓			✓		
Bank Swallow *Riparia riparia*	✓		✓	✓	✓	✓			✓		
Rough-winged Swallow *Stelgidopteryx ruficollis*	✓		✓	✓	✓	✓			✓		
Barn Swallow *Hirundo rustica*	✓		✓	✓	✓	✓			✓		
Cliff Swallow *Petrochelidon pyrrhonota*	✓		✓	✓				✓			

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Purple Martin *Progne subis*	✓			✓	✓				✓		
Blue Jay *Cyanocitta cristata*	✓		✓	✓		✓	✓				✓
Common Crow *Corvus brachyrhynchos*	✓		✓			✓	✓				✓
Black-capped Chickadee *Parus atricapillus*	✓		✓			✓	✓				✓
White-breasted Nuthatch *Sitte carolinensis*	✓		✓				✓				✓
Red-breasted Nuthatch *Sitta canadensis*	✓			✓			✓	✓		✓	
Brown Creeper *Certhia familiaris*	✓			✓			✓	✓		✓	
House Wren *Troglodytes aedon*	✓		✓	✓		✓	✓		✓		
Long-billed Marsh Wren *Telmatodytes palustris*	✓	✓		✓	✓				✓		
Short-billed Marsh Wren *Cistothorus platensis*	✓	✓		✓	✓	✓			✓		
Gray Catbird *Dumetella carolinensis*	✓		✓	✓		✓			✓		
Brown Thrasher *Toxostoma rufum*	✓		✓	✓		✓			✓		
American Robin *Turdus migratorius*	✓		✓	✓		✓	✓		✓		
Wood Thrush *Hylocichla mustelina*	✓		✓				✓	✓	✓		
Hermit Thrush *Hylocichla guttata*	✓			✓			✓	✓			

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Swainson's Thrush *Hylocichla ustulata*	✓			✓		✓	✓	✓			
Veery *Hylocichla fuscescens*	✓			✓			✓	✓	✓		
Eastern Bluebird *Sialia sialis*	✓			✓		✓	✓	✓	✓		
Blue-gray Gnatcatcher *Polioptila caerulea*	✓			✓			✓	✓			
Golden-crowned Kinglet *Regula satrapa*	✓			✓			✓	✓			
Ruby-crowned Kinglet *Regula calendula*	✓			✓			✓	✓			
Water Pipit *Anthus spinoletta*	✓			✓		✓		✓			
Cedar Waxwing *Bombycilla cedrorum*	✓		✓			✓	✓	✓	✓		
Northern Shrike *Lanius excubitor*	✓			✓		✓		✓		✓	
Starling *Sturnus vulgaris*	✓			✓		✓	✓				✓
Red-eyed Vireo *Vireo olivaceus*	✓		✓	✓			✓		✓		
Warbling Vireo *Vireo gilvus*	✓		✓	✓		✓	✓		✓		
Black-and-white Warbler *Mniotilta varia*	✓			✓			✓	✓			
Golden-winged Warbler *Vermivora chrysoptera*	✓			✓		✓		✓	✓		
Blue-winged Warbler *Vermivora pinus*	✓			✓		✓		✓	✓		

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Tennessee Warbler *Vermivora peregrina*	✓			✓			✓	✓			
Orange-crowned Warbler *Vermivora celata*	✓			✓			✓	✓			
Nashville Warbler *Vermivora ruficapilla*	✓			✓			✓	✓			
Northern Parula *Parula americana*	✓			✓			✓	✓			
Yellow Warbler *Dendroica petechia*	✓		✓	✓		✓			✓		
Magnolia Warbler *Dendroica magnolia*	✓			✓		✓	✓	✓			
Cape May Warbler *Dendroica tegrina*	✓			✓			✓	✓			
Yellow-rumped Warbler *Dendroica coronata*	✓			✓		✓	✓	✓			
Black-throated Green Warbler *Dendroica virens*	✓			✓			✓	✓			
Chestnut-sided Warbler *Dendroica pensylvanica*	✓		✓	✓		✓		✓	✓		
Bay-breasted Warbler *Dendroica castanea*	✓			✓			✓	✓			
Blackpoll Warbler *Dendroica striata*	✓			✓			✓	✓			
Pine Warbler *Dendroica pinus*	✓			✓			✓	✓			
Palm Warbler *Dendroica palmarum*	✓			✓			✓	✓			
Ovenbird *Seirus aurocapillus*	✓		✓	✓			✓		✓		

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Northern Waterthrush *Seiurus noveboracensis*	✓			✓		✓	✓	✓			
Mourning Warbler *Oporornis philadelphia*	✓		✓	✓		✓		✓	✓		
Common Yellowthroat *Geothlypis trichas*	✓		✓	✓	✓	✓			✓		
Wilson's Warbler *Wilsonia pusilla*	✓			✓		✓	✓	✓			
American Redstart *Setophaga ruticilla*	✓		✓	✓		✓	✓	✓	✓		
House Sparrow *Passer domesticus*	✓			✓		✓					✓
Bobolink *Dolichonyx orzivorus*	✓		✓	✓	✓	✓		✓	✓		
Eastern Meadowlark *Sturnella magna*	✓		✓	✓		✓			✓		
Western Meadowlark *Sturnella neglecta*	✓		✓			✓			✓		
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	✓	✓		✓	✓				✓		
Red-winged Blackbird *Agelaius phoeniceus*	✓	✓		✓	✓	✓	✓		✓		
Northern Oriole *Icterus galbula*	✓		✓				✓		✓		
Rusty Blackbird *Euphagus carolinus*	✓			✓		✓		✓			
Brewer's Blackbird *Euphagus cyanocephalus*	✓		✓	✓	✓	✓		✓			
Common Grackle *Quiscalus quiscala*	✓		✓	✓	✓	✓	✓		✓		

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Brown-headed Cowbird *Molothrus ater*	✓		✓	✓	✓	✓	✓		✓		
Cardinal *Cardinalis cardinalis*	✓		✓			✓	✓				✓
Rose-breasted Grosbeak *Pheucticus ludivicianus*	✓		✓			✓	✓		✓		
Indigo Bunting *Passerina cyanea*	✓		✓			✓			✓		
Dickcissel *Spiza americana*	✓			✓		✓		✓	✓		
Purple Finch *Carpodacus purpureus*	✓			✓			✓	✓		✓	
Pine Siskin *Spinus pinus*	✓			✓		✓	✓	✓			
American Goldfinch *Spinus tristis*	✓		✓	✓		✓	✓		✓		
Rufous-sided Towhee *Pipilo erythrophthalmus*	✓		✓	✓		✓	✓		✓		
Savannah Sparrow *Passerculus sandwichensis*	✓		✓	✓		✓			✓		
Grasshopper Sparrow *Ammodramus savannarum*	✓		✓			✓			✓		
Sharp-tailed Sparrow *Ammospiza caudacuta*	✓			✓	✓	✓		✓			
Vesper Sparrow *Pooecetes gramineus*	✓		✓	✓		✓			✓		
Dark-eyed Junco *Junco hyemalis*	✓			✓		✓	✓	✓		✓	
Tree Sparrow *Spizella aborea*	✓			✓	✓	✓		✓		✓	

Table 2-8 cont.

	USE				HABITAT			STATUS			
	Foraging	Documented Nesting	Possible Nesting	Resting	Open Water & Marsh	Seral Community	Woodland	Migrant Only	Summer Resident	Winter Resident	Permanent Resident
Chipping Sparrow *Spizella passerina*	✓		✓	✓		✓			✓		
Field Sparrow *Spizella pusilla*	✓		✓	✓		✓			✓		
White-crowned Sparrow *Zonotrichia leucophrys*	✓			✓		✓		✓			
White-throated Sparrow *Zonotrichia albicollis*	✓			✓		✓		✓			
Fox Sparrow *Passerella iliaca*	✓			✓		✓		✓			
Lincoln's Sparrow *Melospiza lincolnii*	✓			✓	✓	✓		✓			
Swamp Sparrow *Melospiza georgiana*	✓	✓		✓	✓	✓			✓		
Song Sparrow *Melospiza melodia*	✓		✓			✓			✓		
Lapland Longspur *Calcarius lapponicus*	✓			✓		✓		✓		✓	

Table 2-9. Species recorded on Survey Areas 1-5, 1979-80, in birds per party hour.

	BIRDS OBSERVED PER PARTY HOUR				
	1979	1980			
	Fall	Spring	Breeding	Summer	Fall
GAVIIDAE					
Common Loon		0.02			
PODICIPEDIDAE					
Horned Grebe				0.05	
Pied-billed Grebe	1.53	0.38		0.50	1.30
ARDEIDAE					
Great Blue Heron	0.29	1.57	1.42	1.61	0.20
Green Heron		0.75	2.06	4.16	0.20
Black-crowned Night Heron		0.06		0.14	
Yellow-crowned Night Heron				0.02	
American Bittern	0.38				0.25
Least Bittern		0.08	1.06	0.83	
ANATIDAE					
Canada Goose	0.19	0.32			0.05
Mallard	16.13	26.54	3.84	9.00	17.50
Black Duck	0.29	0.90			0.20
Gadwall	0.10	1.46		0.09	0.35
Pintail	1.05	0.47			0.70
Green-winged Teal	4.58	1.70	0.03		0.90
Blue-winged Teal	1.43	19.61	2.85	11.63	7.55
American Wigeon	4.87	9.92		0.55	3.00
Northern Shoveler		2.41			1.10
Wood Duck	0.10	2.13	5.23	9.83	2.90
Redhead		0.21			
Ring-necked Duck		6.15			
Lesser Scaup		0.68			0.60
Common Goldeneye		0.04			
Bufflehead		0.45			
Duck spp.	2.00				0.70
Ruddy Duck					0.05
Hooded Merganser	0.19	0.17			0.05
Red-breasted Merganser		0.58			
ACCIPITRIDAE					
Sharp-shinned Hawk		0.04		0.14	0.05
Cooper's Hawk		0.02		0.05	0.05
Red-tailed Hawk	1.05	0.34	0.06	0.50	0.35
Red-shouldered Hawk		0.02			
Broad-winged Hawk		0.02		0.05	0.05
Rough-legged Hawk		0.02			
Marsh Hawk	0.38	0.04		0.09	0.20
PANDIONIDAE					
Osprey		0.04		0.05	

Table 2-9 cont.

	BIRDS OBSERVED PER PARTY HOUR				
	1979	1980			
	Fall	Spring	Breeding	Summer	Fall
FALCONIDAE					
American Kestrel		0.02		0.14	
PHASIANIDAE					
Ring-necked Pheasant	0.67		0.16		
Gray Partridge					
RALLIDAE					
Virginia Rail		0.08		0.25	0.05
Sora	0.76	3.93	0.64	2.54	0.05
Common Gallinule		0.15	0.03		0.05
American Coot	26.62	41.48	4.49	33.61	131.40
CHARADRIIDAE					
Killdeer	0.86	0.30	0.68	1.43	1.00
SCOLOPACIDAE					
Common Snipe	23.95	1.31	0.32	0.50	2.75
Spotted Sandpiper		0.27	0.25	0.23	
Greater Yellowlegs	0.48	0.17		0.18	0.40
Lesser Yellowlegs	0.80	1.18		0.46	0.35
Pectoral Sandpiper	0.95	1.35		0.65	0.05
Dowitcher					0.05
LARIDAE					
Herring Gull	4.87	0.73		0.46	1.05
Ring-billed Gull	3.15	0.36		0.14	14.00
Gull spp.	0.19			3.92	0.10
Common Tern					0.10
Black Tern		0.15	0.80	0.09	
COLUMBIDAE					
Mourning Dove	0.48	0.51	0.32	2.63	1.50
Rock Dove		0.21	0.35	0.18	1.05
CUCULIDAE					
Yellow-billed Cuckoo		0.06		0.05	0.05
Black-billed Cuckoo			0.03	0.05	
CAPRIMULGIDAE					
Common Nighthawk		0.04			
APODIDAE					
Chimney Swift		2.73	0.32	1.98	0.20
TROCHILIDAE					
Ruby-throated Hummingbird					0.05
ALCEDINIDAE					
Belted Kingfisher	0.10	0.30	0.09	0.78	0.20

Table 2-9 cont.

	BIRDS OBSERVED PER PARTY HOUR				
	1979	1980			
	Fall	Spring	Breeding	Summer	Fall
PICIDAE					
Common Flicker		0.60	0.16	0.78	0.05
Red-bellied Woodpecker		0.04			0.15
Red-headed Woodpecker		0.04			
Hairy Woodpecker				0.05	
Downy Woodpecker	0.76	0.17	0.03	0.05	0.55
TYRANNIDAE					
Eastern Kingbird		0.23	0.45	0.23	
Great Crested Flycatcher		0.06	0.19	0.05	
Eastern Phoebe		0.04		0.09	
Willow Flycatcher		0.02	0.09	0.05	
Eastern Wood Pewee			0.06	0.05	
HIRUNDINDAE					
Tree Swallow		10.69	2.00	15.24	0.05
Bank Swallow		4.43	5.66	0.74	
Rough-winged Swallow		0.81	0.16		
Barn Swallow	0.19	6.00	1.65	21.79	
Cliff Swallow				0.09	
Purple Martin		1.14	0.19	0.88	
CORVIDAE					
Blue Jay	0.57	0.53	0.26	3.69	0.25
Common Crow	3.63	0.25	0.19	2.17	1.30
PARIDAE					
Black-capped Chickadee	0.86	0.40	0.32	0.92	0.55
SITTIDAE					
Red-breasted Nuthatch					0.05
TROGLODYTIDAE					
House Wren			0.03		
Long-billed Marsh Wren	0.57	3.85	17.92	24.70	6.45
Short-billed Marsh Wren		0.06			
MIMIDAE					
Gray Catbird		0.04	0.13	0.09	
Brown Thrasher		0.06	0.03		
TURDIDAE					
American Robin	11.45	1.48	0.26	3.97	4.20
Wood Thrush			0.03	0.05	
Swainson's Thrush				0.09	
Veery				0.05	
Eastern Bluebird					0.05
SYLVIIDAE					
Golden-crowned Kinglet					0.10
Ruby-crowned Kinglet	0.10	0.06			0.25

Table 2-9 cont.

	BIRDS OBSERVED PER PARTY HOUR				
	1979	1980			
	Fall	Spring	Breeding	Summer	Fall
MOTACILLIDAE					
Water Pipit				0.05	0.05
BOMBYCILLIDAE					
Cedar Waxwing		0.12	0.13	1.71	
LANIIDAE					
Northern Shrike		0.02			
STURNIDAE					
Starling	1.34	0.38			0.05
VIREONIDAE					
Red-eyed Vireo			0.03		
Warbling Vireo		0.02			
PARULIDAE					
Black-and-white Warbler		0.06		0.05	
Tennessee Warbler		0.02		0.05	
Yellow Warbler		0.71	0.09		
Magnolia Warbler		0.23			
Yellow-rumped Warbler	2.48	0.73		3.42	2.35
Black-throated Green Warbler				0.05	
Blackpoll Warbler				0.05	
Pine Warbler				0.05	
Palm Warbler	0.10	0.60			0.05
Northern Waterthrush	0.10	0.04		0.05	
Common Yellowthroat	0.10	1.44	1.74	2.35	0.20
Wilson's Warbler		0.04			
American Redstart		0.04			
ICTERIDAE					
Bobolink		0.06	0.32	0.65	
Eastern Meadowlark		0.21			
Western Meadowlark					0.05
Yellow-headed Blackbird		1.20	6.33	3.00	0.05
Red-winged Blackbird	115.55	51.49	43.69	99.95	359.35
Northern Oriole		0.19	0.16	0.05	
Rusty Blackbird	12.50	1.27			10.30
Brewer's Blackbird	0.29	0.04			
Common Grackle	6.58	6.37	1.58	1.98	11.60
Brown-headed Cowbird	3.34	1.09	0.03	2.31	1.00
FRINGILLIDAE					
Cardinal	0.38	0.27	0.06	0.05	0.05
Rose-breasted Grosbeak		0.06	0.03	0.32	
Indigo Bunting		0.02	0.16	0.18	
Dickcissel			0.03		
Pine Siskin		0.02			
American Goldfinch	0.10	0.17	0.42	1.20	0.80

Table 2-9 cont.

	BIRDS OBSERVED PER PARTY HOUR				
	1979	1980			
	Fall	Spring	Breeding	Summer	Fall
Savannah Sparrow					0.20
Sharp-tailed Sparrow				0.18	
Vesper Sparrow	0.10				1.00
Dark-eyed Junco	1.91				0.70
Tree Sparrow	1.43	0.73			
Chipping Sparrow		0.04			
White-crowned Sparrow	0.38				
White-throated Sparrow	6.39				0.35
Fox Sparrow	0.10				0.05
Lincoln's Sparrow	0.10				
Swamp Sparrow	21.28	7.40	5.11	5.26	11.50
Song Sparrow	2.48	2.99	0.55	1.43	1.20
Lapland Longspur	0.19				0.10

Table 2-10. Nests of typical wetland bird species recorded breeding on Survey Areas 1, 2 and 4, 28 May-16 July 1980.

SPECIES	NUMBER OF NESTS Survey Area 1	Survey Area 2	Survey Area 4
Pied-billed Grebe	1		5
Mallard		1	
Blue-winged Teal		1?	
Least Bittern	1	3	1
Sora	1		1
Virginia Rail	1		1
Common Gallinule			1
American Coot	11	3	27
Black Tern	2		1
Long-billed Marsh Wren	2	154* 9†	19* 1†
Red-winged Blackbird	41	45	53
Yellow-headed Blackbird	2	3	1
Swamp Sparrow			1
Unidentified passerine		2	1
Unidentified platform nest		2	1
TOTAL	62	223	114

* Dummy nests.

† With eggs or young.

Table 2-11. Endangered and threatened birds of Wisconsin. From Wisconsin Department of Natural Resources, Office of Endangered and Nongame Species, 1979.

ENDANGERED

Double-crested Cormorant
Phalacrocorax auritus
Bald Eagle*
Haliaeetus leucocephalus
Osprey
Pandion haliaetus
Peregrine Falcon†
Falco peregrinus
Piping Plover
Charadriud melodus
Forster's Tern
Sterna forsteri
Common Tern
Sterna hirundo
Barn Owl
Tyto alba

THREATENED

Great Egret
Casmerodium albus
Greater Prairie Chicken
Tympanuchus cupido pinnatus
Cooper's Hawk
Accipiter cooperii
Red-shouldered Hawk
Buteo lineatus
Loggerhead Shrike
Lanius ludovicianus

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*Also U.S. Threatened.

†Also U.S. Endangered.

Table 2-12. Endangered and threatened birds of Illinois. From Illinois Department of Conservation, 1980.

ENDANGERED

✓Double-crested Cormorant
Phalacrocorax auritus
✓Snowy Egret
Egretta thula
✓Great Egret
Casmerodius albus
✓Little Blue Heron
Florida caerulea
✓American Bittern
Botaurus lentiginosus
✓Black-crowned Night Heron
Nycticorax nycticorax
Mississippi Kite
Ictinia mississippiensis
Cooper's Hawk
Accipiter cooperii
Red-shouldered Hawk
Buteo lineatus
Swainson's Hawk
Buteo swainsoni
Bald Eagle*
Haliaeetus leucocephalus
✓Osprey
Pandion haliaetus
✓Marsh Hawk
Circus cyaneus
Peregrine Falcon*
Falco peregrinus
Greater Prairie Chicken
Tympanuchus cupido
✓Yellow Rail
Coturnicops noveboracensis

✓Black Rail
Laterallus jamaicensis
✓Purple Gallinule
Porphyrula martinica
✓Piping Plover
Charadrius melodus
Eskimo Curlew*
Numenius borealis
Upland Sandpiper
Bartramia longicauda
✓Wilson's Phalarope
Steganopus tricolor
✓Forster's Tern
Sterna forsteri
✓Common Tern
Sterna hirundo
✓Least Tern
Sterna albifrons
✓Black Tern
Chlidonias niger
Barn Owl
Tyto alba
Long-eared Owl
Asio otus
Short-eared Owl
Asio flammeus
Brown Creeper
Certhia familiaris
Bachman's Warbler*
Vermivora bachmanii
✓Yellow-headed Blackbird
Xanthocephalus xanthocephalus
Bachman's Sparrow
Aimophila aestivalis

THREATENED

✓Common Gallinule
Gallinula chloropus
Bewick's Wren
Thryomanes bewickii
Veery
Catharus fuscescens

Loggerhead Shrike
Lanius ludovicianus
Swainson's Warbler
Limnothlypis swainsonii
Brewer's Blackbird
Euphagus cyanocephalus
Henslow's Sparrow
Ammodramus henslowii

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*Also U.S. Endangered.

✓ Wetland species.

Table 2-13. Calculated Average Species Index and Faunal Index for Survey Areas 1, 2 and 4.

SPECIES	FAUNAL INDEX POINT VALUE*
Pied-billed Grebe	200
Least Bittern	80
Mallard	40
Blue-winged Teal	80
Virginia Rail	80
Sora	80
Common Gallinule	200
American Coot	80
Black Tern	200
Long-billed Marsh Wren	80
Short-billed Marsh Wren	20
Yellow-headed Blackbird	80
Red-winged Blackbird	10
Swamp Sparrow	40

TOTAL SPECIES POINTS = 1150

EXPECTED TOTAL SPECIES POINTS (Fig. 2-2) = 900

AVERAGE SPECIES INDEX = 82.12

EXPECTED VALUE FROM FIG. 2-2 = 64.3

FAUNAL INDEX BASED ON MEAN SIZE OF THREE SURVEY AREAS = 630.65

EXPECTED VALUE FROM FIG. 2-2 = 767.8

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* From Graber and Graber, Ref. 2

Table 2-14. Mean Habitat Values Established for Waterfowl, Fall 1979.

Evaluation Element: WATERFOWL

Habitat Type: MERAMEC RIVER/RIVERINE

CHARACTERISTICS	POSSIBLE SCORE	ACTUAL SCORE*
I. Distance to essential habitat (timber)		I. 8.00
A) 1/3 to 0 mile (0.53 to 0 km)	6-10	
B) 2/3 to 1/3 mile (1.1 to 0.53 km)	3- 5	
C) 1 to 2/3 mile (1.6 to 1.1 km)	1- 2	
NOTE: If distance exceeds 1 mile (1.6 km), cease evaluating. Enter 1 on line (8) as the HABITAT UNIT VALUE for this Habitat Type.		
II. Preferred food plant diversity (consider only species in significant amounts)		II. 7.75
A) many species	8-10	
B) some species	4- 7	
C) few species	1- 3	
III. Emergent vegetation		III. 6.50
A) covers 40-60% of water's surface	8-10	
B) covers more than 80% of water's surface	4- 7	
C) covers less than 40% of water's surface	1- 3	
IV. Aquatic cover		IV. NA
A) overhanging vegetation within 1 foot (0.3 m) of water's surface	8-10	
B) overhanging vegetation within 2-3 feet (0.6-0.9 m) of water's surface	4- 7	
C) overhanging vegetation more than 4 feet (1.2 m) above water's surface	1- 3	
V. Water flow/quality		V. 5.75
A) many quiet pools/clear	8-10	
B) some quiet pools/slightly turbid	4- 7	
C) few quiet pools/turbid	1- 3	
VI. Roosting, loafing, preening sites		VI. 6.00
A) many	8-10	
B) some	4- 7	
C) few	1- 3	
VII. External edge		VII. 4.25
A) river curves at intervals of 1/8 mile (0.2 km) or less	5	
B) river curves at intervals of 1/4 mile (0.4 km)	3- 4	
C) river curves at intervals of more than 1/4 mile (0.4 km)	1- 2	
VIII. Terrestrial cover		VIII. 4.00
A) banks moderately vegetated	5	
B) banks heavily vegetated	3- 4	
C) banks sparsely vegetated	1- 2	

Table 2-14 Continued.

IX. NA

IX. Water conditions

A) bank timber flooded for 1-3 months...........	5
B) bank timber flooded for less than 1 month....	3- 4
C) no flooded timber...........................	1- 2

*IF CHARACTERISTIC NOT APPLICABLE, ENTER NA AND DO NOT COUNT IT AS A CHARACTERISTIC USED.

(1) Total scores I-VI...........................	(1) 34
(2) Number of CHARACTERISTICS used in (1).......	(2) 5
(3) (1) ÷ (2)...................................	(3) 6.8
(4) Total scores VII-IX.........................	(4) 8.25
(5) Number of CHARACTERISTICS used in (4).......	(5) 2
(6) (4) ÷ (5)...................................	(6) 4.13
(7) (3) + (6)...................................	(7) 10.93
(8) (7) x 2÷3...................................	(8) 7.28 HABITAT UNIT VALUE

PART 3: FISH INVENTORY AND HABITAT EVALUATION

David W. Greenfield, Ph.D.

INTRODUCTION

The fish fauna is one of the more obvious components of the aquatic community, often reflecting the quality of the habitat. In addition, fishes provide a source of recreation for fishermen and thus become an important factor in determining public use of wetland areas.

The fish fauna was sampled and evaluted in terms of the occurrence and relative abundance of the species present in the various habitats within the Project Area. Information also was gathered on the spawning of the various fish species and use of the habitats as nursery sites within the Project Area. Based on an evaluation of the kinds of species present and their use of the Project Area for residency and spawning, an evaluation was made as to the quality of the habitat for fishes now and in the future.

METHODS

Collections were made on 21 October 1979, 29 March 1980, 10-14 May 1980, 7-9 June 1980, and 2-3 July 1980, using a 15-meter bag seine with 22-mm mesh wings and an 11-mm mesh bag, a 7.6-meter bag seine with a 5-mm mesh, or a 4.6-meter minnow seine with a 2-mm mesh. Specimens either were preserved in a 10% formalin solution in the field, returned to the laboratory, washed in water and transferred to 40% isopropyl alcohol or, if readily identifiable in the field, were measured and returned to the water. In the laboratory, specimens were identified using Smith (Ref. 1), Hubbs and Lagler (Ref. 2), Trautman (Ref. 3), Becker and Johnson (Ref. 4) and Pflieger (Ref. 5). Measurements of specimens were made using dial calipers to the nearest 0.1 mm and are reported as standard lengths unless otherwise stated (Ref. 2). Representative samples of fish species collected during the project have been deposited at the Field Museum of Natural History, and the Northern Illinois University fish museum collection.

Description of Sampling Sites

Sampling sites are identified by letter and are arranged from north to south within the Project Area, except for Sites J, K. and L (Fig. 3-1). River widths, depths and flow rates are reported for low water periods. During periods of flooding these dimensions increase greatly. Water temperatures at the sites at various sampling times are listed in Table 3-1.

Sampling Site A.--Des Plaines River from bridge crossing I-94 to U.S. Route 41 to 100 meters downriver. This locality is downriver from the confluence of the Root River with the Des Plaines River and includes the confluence of the Kilbourn Road Ditch. Current flow is moderate in this area, resulting in riffles at various localities. The substrate varies from soft mud under the bridge, mixtures of rock, sand and mud in pools and quiet areas to mixtures of sand and rock in riffle areas. Aquatic vegetation is lacking, but terrestrial vegetation extends into the water along the river bank providing limited cover. During periods of heavy rain extensive areas of canary grass are flooded. The width of the river varies from 4.5 to 9 meters; depth varies from 0.3 to 1.2 meters. This site was sampled during October, March, May, June and July.

Sampling Site B.--Des Plaines River from bridge crossing County Highway C to 1.1 kilometers downriver. There is moderate current flow, resulting in riffles at various localities. The substrate consists of mixtures of rock and sand/mud. Aquatic vegetation is lacking and little terrestrial vegetation extends into the water to provide cover. Fallen trees and submerged logs are present throughout this area. The riverbank is lined with trees and brush, providing considerable shading. Width of the river varies from about 15 meters immediately downriver from the bridge to 3 meters farther downriver, and depth varies from 0.2 to 0.9 meters. This site was sampled during October, March, May and June.

Sampling Site C.--Canal extending from the Pleasant Prairie sewage treatment plant southwest 1.2 kilometers to its junction with the Des Plaines River. The confluence is approximately 0.6 kilometers south of the southern end of Sampling Site B. This is a relatively straight, dredged canal with steep banks covered with grass. Trees border the canal near its confluence with the Des Plaines River. Current flow is virtually nil; any flow towards the river is provided from the outflow of the sewage treatment plant holding pond and field runoff. The substrate is soft mud throughout. Near the confluence with the Des Plaines River the depth of the mud is approximately 0.9 meters, so that during periods of low water walking through the area results in mud rising to the surface of the water. The width of the canal is approximately 6.0 meters, with a maximum depth of 0.9 meters. This site was sampled during May, June and July.

Sampling Site D.--Des Plaines River from the confluence of the Pleasant Prairie sewage treatment plant canal (Sampling Site C) south for approximately 1.6 kilometers to the confluence of a canal coming from the power plant east of County Highway H. Current flow is moderate in this area. The substrate is uniform firm mud and sand, with no rock. Width of the river varies from 4.6 to 7.5 meters; depth ranges from 0.3 to 1.2 meters. The majority of this area is bordered by agricultural fields, with scattered trees and grass near the river banks. This site was sampled once during May.

Sampling Site E.--Canal extending from the power plant east of County Highway H, southwest along the northern edge of the gravel pit to its confluence with the Des Plaines River. The length of the canal from County Highway H to the Des Plaines River is approximately 2.4 kilometers. This is a relatively straight, dredged channel with moderately steep banks covered with grass. There are no trees bordering the canal except for a small section adjacent to County Highway H. Current flow is virtually nil and the substrate is soft mud throughout. Width of the canal is approximately 6.0 meters, with a maximum depth of 1.2 meters. This site was sampled once in May.

Sampling Site F.--Des Plaines River from confluence of canal from the power plant (Sampling Site E) south approximately 1.6 kilometers to the confluence of a canal west of and in line with County Highway Q. Current flow is moderate and the habitat in this area is variable. The substrate is mostly firm mud and sand in narrower portions of the river, but it changes to soft mud in a wide section of the river in the southern half of the sampling site and in a small side lagoon north of the wide area. The river banks are fairly heavily wooded, with the agricultural areas being located a greater distance from the river than in areas to the north. The side lagoon is bordered with a heavy stand of river bulrushes. The wide portion of the river also is bordered with river bulrushes. Lily pads are growing in the wide portion of the river. The width of the river varies from 6 to 30 meters and depth ranges from 0.6 to 1.3 meters. This site was sampled once in May.

Sampling Site G.--Canal extending from the Des Plaines River east for approximately 1.2 kilometers to within 30 meters of the Chicago and Northwestern Railroad tracks and opposite the end of County Highway Q. The canal is bordered by dikes on each side, with several breaks in the dikes allowing water to flow both north and south from adjacent flooded marsh areas. At its west end, the canal turns north for about 50 meters and then empties into the Des Plaines River through a flood gate in the dike. Because the flood gate is higher than the water level of the Des Plaines River, except during high flood stages, fishes usually are prevented from moving between the river and the canal. If the control valves are opened, however, fishes could be washed into the river.

This is a relatively straight, dredged channel with steep banks covered with grass. Below the water level the banks are undercut, probably as a result of the burrowing of muskrats. Scattered trees are present along the southeastern half of the canal and signs of beaver are evident. The eastern end of the canal widens into a small, relatively deep (2.5 meters) lake. The canal is about 9 meters wide and 2 meters deep, and has a soft mud substrate. No detectable current is present when the water control valves are closed. Terrestrial vegetation that extends into the canal along its length, and aquatic vegetation provide cover for fishes. This site was sampled during October, March, May, June and July.

Sampling Site H.--Des Plaines River from the confluence of the canal west of and in line with County Highway Q (Sampling Site G) south for approximately 2.3 kilometers to a sharp eastward bend in the river south of the Pheasant Valley Hunt Club, opposite 116th Street. Habitat and current flow in this area are variable. In the southern half of the area the substrate is mostly mud, varying from firm to soft, and current flow is moderate. Width of the river in this section is relatively uniform and approximately 7.5 meters with a maximum depth of 1.2 meters. The river banks are bordered by open fields with grass but heavy stands of river bulrushes occur in the southernmost portion of the area. The northern half of the study area is bordered by deciduous woods that provide shade and cover. River flow is variable in the northern half of the site, with swift currents occurring in the narrowest parts. These swift riffle areas have a rock and gravel substrate. The remainder of the areas within the northern half of the sampling site have more moderate current flow and substrates of firm mud and sand. This site was sampled during May, June and July.

Sampling Site I.--Des Plaines River from bridge on County Highway ML north about 1.0 kilometer upriver. The river immediately upstream from the bridge is wide (ca. 50 meters) and shallow (to 0.6 meters) with a soft mud bottom. The shoreline is covered with river bulrushes. Current flow is very slow in this portion of the river because of its width. At the north end of this wide area the river narrows to a small channel about 6 meters wide and 1.6 meters deep, with a moderate current; the substrate is a mixture of soft mud and sand, and the shoreline is covered with river bulrushes. This upper section adjoins the southern portion of Sampling Site H. This site was sampled during October, March, May, June and July.

Sampling Site J.--Pleasant Lake, largest and westernmost lake on the Girl Scout property, west of the Des Plaines River and west of Sampling Site H. The lake is approximately 0.8 kilometers long and 0.1 kilometers wide at its greatest width, with a depth in excess of 1.2 meters. The lake is bordered by river bulrushes, and aquatic vegetation (*Utricularia* and *Myriophyllum*) is also present. The substrate is soft mud. This site was sampled in May and July.

Sampling Site K.--Canal (rectangularly shaped) on the Girl Scout property, north of Sampling Site J and west of the Des Plaines River. The southern arm of the canal (oriented east-west) is approximately 0.95 kilometers in length, the eastern and shortest portion (oriented north-south) is 0.4 kilometers, and the northern arm (oriented east-west) is 0.74 kilometers long. The arms of this dredged canal are straight, steep and grass covered. The sides of the canals are higher than the surrounding landscape, which is relatively open. Current flow is nil and the substrate is soft mud throughout. Width of the canal is approxiamtely 9 meters, with a maximum depth of 1.2 meters. Aquatic vegetation is present (*Myriophyllum* and *Ceratophyllum*), often in large quantities. This site was sampled in May, June and July.

Sampling Site L.--Small lake, east of Pleasant Lake (Sampling Site J) on the Girl Scout property, west of the Des Plaines River. The lake is approximately 20 meters long and 60 meters wide at its greatest width with a depth in excess of 1.2 meters. The lake is bordered by a heavy stand of river bulrush. The substrate is soft mud and aquatic vegetation is present. This site was sampled in May.

RESULTS

Fish Fauna by Sites

A total of 32 species of fishes was collected from the Project Area; 24 from Site A, 17 from Site B, 10 from Site C, 16 from Site D, 11 from Site E, 20 from Site F, 17 from Site G, 22 from Site H, 21 from Site I, 10 from Site J, 15 from Site K, and 7 from Site L (Table 3-2). No endangered or threatened species (see Table 3-6) were collected or observed in the Project Area.

Site A had the greatest number of fish species (24), with the sand shiner, *Notropis stramineus*, being most abundant, followed by the Johnny darter, *Etheostoma nigrum*, the spotfin shiner, *Notropis spilopterus*, the bluntnose minnow, *Pimephales notatus*, the green sunfish, *Lepomis cyanellus*, and the blackstripe topminnow, *Fundulus notatus*. A single specimen of the northern mimic shiner (*Notropis volucellus volucellus*) was taken at this site but not at other sites in the Project Area. The only other species in this category was the bigmouth shiner (*Notropis dorsalis*) represented by nine individuals. The following species of gamefishes were present in this area: northern pike (*Esox lucius*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), warmouth (*Lepomis* *gulosus*), yellow bullhead (*Ictalurus natalis*) and black bullhead (*Ictalurus melas*). Ripe white sucker males (*Catostomus commersoni*) were observed in this area in March, and ripe male golden shiners (*Notemigonus chrysoleucas*) were collected in May. Juveniles of the brook stickleback (*Culaea inconstans*) and the sand shiner were collected in June, whereas in July juveniles of the following species were taken: white sucker, spotfin shiner, creek chub (*Semotilus atromaculatus*), Johnny darter and the blackside darter (*Percina maculata*).

Site B ranked fifth (tied with Site G) in the total number of species present (17). The Johnny darter was most abundant, the bluntnose minnow second, with the blackside darter and sand shiner tied for third in abundance. No species was taken at this site that was not collected at other sites in the Project Area. The following species of game fishes were present in this area: black crappie, pumpkinseed (*Lepomis gibbosus*), yellow bullhead and black bullhead. Ripe males and gravid females of the Johnny darter were collected in May.

Site C, with 10 species, ranked ninth (tied with Site J) in the total number of species present. The black bullhead was most abundant, followed by the carp. No species was taken at this site that was not collected at other sites in the Project Area. The following game species were present in this area: black crappie, white crappie (*Pomoxis annularis*), and bluegill. Juveniles of the following species were collected in July: carp (*Cyprinus carpio*) and Iowa darter (*Etheostoma exile*).

Site D had a total of 16 species and was ranked sixth. The most abundant species was the spotfin shiner, with the fathead minnow (*Pimephales promelas*) second and the golden shiner (*Notemigonus chrysoleucas*) third. No species were unique to this area. Six game species were present at this site: northern pike, black bullhead, yellow bullhead, bluegill, white crappie and black crappie. Two juvenile northern pike were collected among the river bulrushes in May.

Site E ranked eighth in the total number of species present (11). The golden shiner was the most abundant species, followed by the green sunfish and the fathead minnow. No species was unique to this area. The following game species were present at this site: northern pike, black bullhead, bluegill and black crappie.

Site F had 20 species, ranking fourth among the areas in number of fish species. The green sunfish was the most abundant species, with the golden shiner next most abundant. Two specimens of the yellow perch (*Perca flavescens*) were collected in the widest portion of this site. This species was not collected at any other locality within the Project

Area. A single individual of the blackchin shiner (*Notropis heterodon*) was taken at this site. This species was only collected at two other sites within the Project Area, being represented by a single individual at each of those sites. The following game species were present at this site: northern pike, black bullhead, pumpkinseed, bluegill, black crappie and yellow perch. Three juvenile northern pike were collected at this site in May.

Site G ranked fifth (tied with Site B) in the total number of species present (17). The most abundant species was the bluegill, followed by the golden shiner. Four individuals of the lake chubsucker (*Erimyzon sucetta*) were collected at this site, but not collected at any other locality within the Project Area. Ten individuals of the largemouth bass (*Micropterus salmoides*) were taken here, only a single individual was captured at any other site. The bowfin (*Amia calva*) was taken here and at two other sites. Game species present at this sampling site were: northern pike, black bullhead, yellow bullhead, pumpkinseed, bluegill, largemouth bass, white crappie, and black crappie. Gravid female central mudminnows (*Umbra limi*) and a ripe male northern pike were collected in March. A ripe male bluegill was taken in May. Juveniles of the following species were captured in June: central mudminnow, brook stickleback, northern pike and Iowa darter. In July, breeding males of the pumpkinseed were taken as were juveniles of the following species: black bullhead, bluegill, largemouth bass, golden shiner, carp and Iowa darter.

Site H had the second greatest number of species present (22). The spotfin shiner was the most abundant species, with the sand shiner second, the green sunfish third and the bluegill fourth in abundance. Four individuals of the creek chub were taken here. This species was collected at only one other locality within the Project Area. The following game species were present at this site: northern pike, black bullhead, yellow bullhead, pumpkinseed, bluegill, and black crappie. Gravid females of the blackstripe topminnow (*Fundulus notatus*) and the spotfin shiner were taken in June along with juvenile blackside darter. Gravid females of the spotfin shiner also were found in July along with juvenile white sucker and blackside darter.

Site I ranked third in the total number of species present (21). The golden shiner was the most abundant species, followed by the spotfin shiner, black crappie and green sunfish. A single individual of the bowfin and the blackchin shiner were taken here and at two other sampling sites. A single individual each of the warmouth and largemouth bass were taken here. These species were collected at only one other site within the Project Area. The following game species were present at this site: northern pike, black bullhead, pumpkinseed, warmouth, bluegill, largemouth bass, white crappie and black crappie. A gravid female blackstripe topminnow was taken in June along with juvenile northern pike. A ripe male spotfin shiner was taken in July.

Site J had a total of 10 species and ranked ninth (tied with Site C) in the total number of species present. The bluegill was the most abundant species and the pumpkinseed second in abundance. No species were unique to this area. The following game species were found: black bullhead, pumpkinseed, bluegill, and black crappie. Juvenile black bullheads were collected in July.

Site K, with 15 species, ranked seventh in the total number of species present. The golden shiner was the most abundant species followed by the black crappie and black bullhead. A single individual of the bowfin and the blackchin shiner were taken here and at two other sampling sites. Game species present at this site were: northern pike, black bullhead, pumpkinseed, bluegill, and black crappie. Ripe males of the black crappie were collected in May. Gravid females of the black bullhead and bluegill were taken in June along with juveniles of the northern pike. Juvenile northern pike, bowfin, black crappie and Iowa darter were taken in July.

Site L ranked tenth in the total number of species present (7). The green sunfish was the most abundant species with the golden shiner second and the bluegill third in abundance. No species were unique to this area. The following game species were present: black bullhead, pumpkinseed, bluegill and black crappie. A gravid female Iowa darter was taken in May.

Fish Reproduction in the Project Area

Evidence of reproduction has been obtained for 19 species within the Project Area. Six of these are game species. Support for reproduction within the area is from three sources: presence of gravid females, presence of ripe males, and presence of juveniles (Table 3-3). The sampling sites where the greatest number of species were reproducing were Site G (10 species), Site A (8 species), and Site K (5 species).

DISCUSSION

Comparison with Adjacent Areas

A total of 32 fish species from ten different families was collected within the Project Area, indicating a relatively diverse fish community. The total number of fish species present in the Project Area has not decreased from the number of species listed for the Des Plaines River by

Greene in 1935 (Ref. 6), who reported a total of 24 species for the entire river in Wisconsin. The composition of the community present has changed, however, presumably as the result of increased siltation and human activities. Table 3-4 lists nine species of fishes recorded prior to 1935 that were not collected in this survey and 16 species collected in 1979-80 that were not recorded by Greene (Ref. 6).

A survey of the fishes in the Des Plaines River in Lake County, Illinois, immediately south of the Project Area, was reported by the Lake County Forest Preserve District (Ref. 7). This survey was based on a report by Erickson (Ref. 8) of the Illinois Department of Conservation. Thirty-one species of fishes were collected in the Lake County survey. A comparison of the fishes taken in Illinois with those recorded in the present survey shows 13 species were taken in Wisconsin that were not recorded in Illinois, and 11 species were taken in Illinois that were not found in this Wisconsin study (Table 3-5). The combined species list from both areas results in a total of 42 species in the Des Plaines River.

Game Fish Survey

Ten of the fish species recorded from the Project Area are listed as game species by the Wisconsin Department of Natural Resources (Ref. 10): northern pike, black bullhead, yellow bullhead, black crappie, white crappie, bluegill, warmouth, pumpkinseed, largemouth bass and yellow perch. Northern pike about 0.9 meters in length and black crappie about 210 mm long were released after capture. Bluegills up to 161 mm and pumpkinseeds up to 125 mm in length were taken. Larger individuals undoubtedly occur within the Project Area; however, because we were not permitted by the Wisconsin Department of Natural Resources to use gill nets in our sampling, information about the occurrence of larger individuals of several of the game species is not available. These game species should provide a source of recreational fishing in the area.

Fish Reproduction

Evidence has been gathered supporting reproduction within the Project Area for six game species (Table 3-3). Localities within the Project Area appear to have varying importance as spawning and nursery sites for the different game species. The northern pike is the earliest member of the fish community in the Project Area to initiate reproduction, beginning spawning as soon as the ice withdraws. Ripe males were collected in March and the first young were collected in May. Spawning takes place over areas of flooded terrestrial vegetation. Much of the floodplain within the Project Area is suitable for spawning, as are portions of the more permanently flooded areas. The marsh areas immediately north of the canal opposite County Highway Q (Sampling Site G) represent one such site. In addition, larval northern pike were collected from areas of flooded river bulrushes along the main channel of the Des Plaines River within Sampling Sites D, F and I. Sampling Site G was also an important spawning locality for bluegill, pumpkinseed, largemouth bass, and black bullhead. The quiet water in the canal at Sampling Site G provides good habitat for nest construction and spawning of all of these species. The canal on the Girl Scout property (Sampling Site K) provides a similar quiet water habitat used by the black crappie for reproduction. Collections at this locality yielded large numbers of black crappies (Table 3-2), including ripe adults and juveniles (Table 3-3).

Several non-game species also reproduce in the canals. The central mudminnow breeds at Sampling Site G, depositing its eggs on aquatic and submerged terrestrial vegetation, as does the golden shiner. This habitat also is used by the brook stickleback, a species that constructs nests in the vegetation. The Iowa darter reproduces at Sampling Site G, in the canal on the Girl Scout property (Sampling Site K), and in the canal from the sewage treatment plant (Sampling Site C). This species deposits its eggs over roots, aquatic vegetation or debris. A gravid female Iowa darter also was taken at Sampling Site L, the small lake on the Girl Scout property. A single juvenile bowfin was captured at Sampling Site K.

Other non-game species utilize various portions of the Des Plaines River as sites for reproduction. The remaining darters spawn in areas of rock, gravel and coarse sand. The Johnny darter was found at Sampling Sites A and B, whereas the blackside darter was found at Sampling Sites A and H. The blackstripe topminnow attaches its eggs to aquatic vegetation, and was found at Sampling Sites H and I where there are heavy stands of river bulrush. The white sucker spawns in gravelly riffles and pools, with the eggs being broadcast over the substrate. This species was taken at Sampling Sites A and H. The creek chub spawns over sand and gravel in nests constructed by the male in pools. Young creek chubs were collected at Sampling Site A. Little is known of the reproductive habits of the sand shiner, but juveniles were caught at Sampling Site A. The spotfin shiner deposits its eggs on submerged logs. Gravid females were taken at Sampling Site H and ripe males at Sampling Site I, whereas juveniles were captured at Sampling Site A.

Habitat Quality

The various areas within the Project Area, including the lakes, canals and river channel, provide a variety of habitats where spawning of both game and non-game species may occur. Thus, the Project Area provides a diversity of suitable sites for fish reproduction within a relatively limited geographic area.

Although the fish community within the Project Area is not unique, it is relatively diverse. The greatest species diversity was found within the main channel of the Des Plaines River, with 24 species at Sampling Site A, 22 at Sampling Site H, 21 at Sampling Site I and 20 at Sampling Site F. The greater number of species within the river is probably a reflection of the greater habitat diversity there, including pools, riffles, areas with heavy stands of river bulrushes, and substrates varying from rock, gravel and sand to firm and soft mud. The number of species found in the various canals and lakes within the Project Area is fewer than in the river channel; however, these areas provide habitats distinct from those in the river where species preferring standing water flourish. The canal at Sampling Site G is one such site, supporting a fish fauna including 17 species.

One of the six fish species (pugnose minnow, Notropis emiliae) reported to occur in the Project Area by Owens Ayres and Associates (Ref. 9) was not taken in this survey. Although we have not examined the specimens, we have reason to suspect that this record of the pugnose minnow is a result of a misidentification. Owens Ayres and Associates (Ref. 9) listed this species as the most abundant one taken by them (234 individuals), with the total lengths of individuals ranging from 32 to 28 mm. The most abundant minnow in our samples was the golden shiner; however, they reported only two individuals of this species, of 67 and 70 mm in total length. Because the golden shiner has a very short snout, like the pugnose minnow, and the diagnostic pelvic-anal ridge is less obvious in smaller individuals, it is likely that the abundant minnows they identified as pugnose minnows actually were small golden shiners. The size range of their specimens supports this explanation.

The single specimen of the northern mimic shiner, Notropis volucellus volucellus, collected at Sampling Site A deserves special mention. Although this subspecies occurs more commonly farther north in Wisconsin, its occurrence in Illinois is sporadic and rare. In Illinois it occurs in a few glacial lakes in the extreme northeastern section of the state and a few tributaries of the Wabash River. The key factor for the occurrence of N. volucellus volucellus seems to be clear water of high quality (Ref. 1). It appears that the decimation of this subspecies in the Midwest is due to siltation and deterioration of water quality.

Other species taken in low number in the Project Area that are indicative of clear water include the yellow perch, the blackchin shiner and the lake chubsucker. The lake chubsucker does well in areas where the water is clear and vegetation is luxuriant (Ref. 1). Greene (Ref. 6) reported this species was represented by only 11 records in Wisconsin, mostly in the southeastern part of the state. Smith (Ref. 1) reports its natural distribution in Illinois consists of approximately four "islands" of localities. This species has disappeared from several Illinois sites where it was known to occur in the 1930's and 1940's.

Another indication of relatively good habitat quality is the presence of the black crappie at all sites. This species is much less tolerant of turbidity and silt than is the white crappie, represented by a single specimen at three sites and two at a fourth site in the Project Area. The black crappie is most abundant in well-vegetated lakes and clear backwaters of rivers (Ref. 1).

The only fish species present that may possibly indicate poor habitat quality is the golden shiner. Smith (Ref. 1) reported this species has great ecological tolerance and can persist in badly polluted and highly turbid streams: "It is a good indicator of polluted or modified habitats whenever it outnumbers other species at a site." The golden shiner was the most abundant species at three sites; however, the black crappie also was very abundant at these sites. This paradox may perhaps be resolved by the fact the golden shiner is characteristic of quiet water habitats, occurring only rarely in stream sections with a noticeable current (Ref. 5) and the canals provide just such habitat. Pflieger (Ref. 5) reported: "It is tolerant of moderate turbidity, but thrives in clear, heavily vegetated habitats."

The overall habitat quality of the Project Area for fishes is good, as indicated by the number and kinds of species present. In addition, the fishes appeared to be free from major infestations of parasites or diseases and generally in good condition, another indication of good quality habitat. The habitat is also of sufficient quality and variety to allow for reproduction of most of the fish species taken within the Project Area.

Suitability of Area for Continued Use by Fishes

Assuming that the Des Plaines River is not severely impacted by pollution from upriver areas, the portion of the river within the Project Area should provide suitable habitat for continued existence and reproduction of fish species. This conclusion also is based on the assumption that the floodplain areas adjacent to the river are not disturbed, because the river bulrushes and adjacent areas of flooded terrestrial vegetation are important breeding sites for several fish species.

The various lakes, ponds and canals within the Project Area should continue to provide suitable habitat for use by fishes, including spawning sites, if the water levels in these areas are maintained and do not receive inputs of pollutants having a negative impact. Draining of these areas or discharge into them of poor quality water would of course reduce their suitability as fish habitat.

Considering the impact from pollution and disturbance the lower Des Plaines River in Illinois has received, the upper reaches in Wisconsin may serve as a refuge for many fish species in that river system. If water quality is improved in future years in the lower Des Plaines River, the upper reaches in Wisconsin could provide a source for repopulation In addition to the main channel of the Des Plaines River, significant habitat for fish species is provided by the canals, lakes, marshes and floodplain within the Project Area. These diverse habitats provide varied sites for reproduction, allowing for the continued existence of a relatively diverse fish fauna within this limited geographic area.

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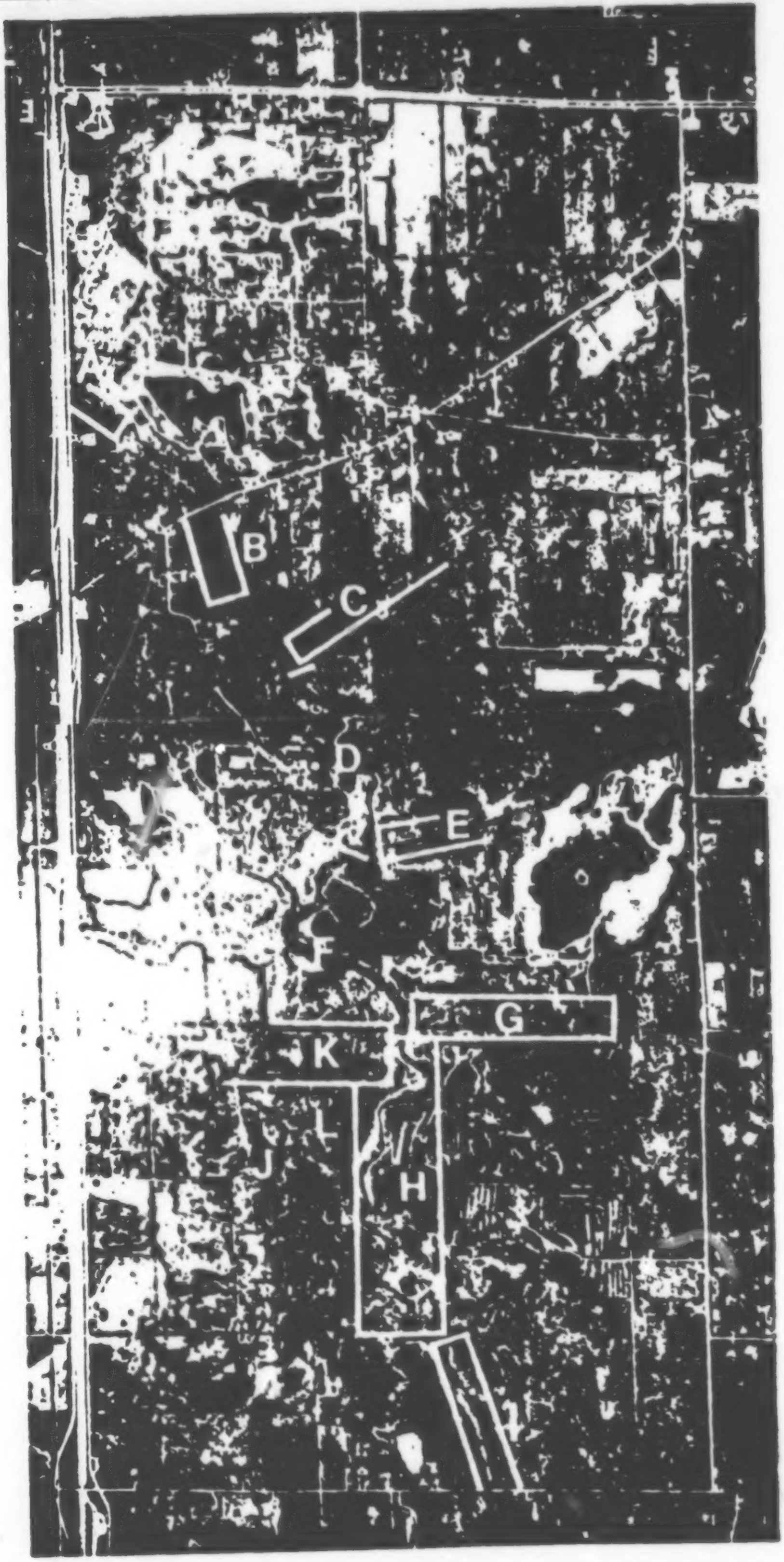

Figure 3-1. Location of Aquatic Sampling Sites A-L within the Project Area.

Table 3-1. Water temperatures (in degrees Celsius) at Sampling Sites A through L from October 1979 through July 1980.

SAMPLING SITES	TEMPERATURES				
	OCT.	MARCH	MAY	JUNE	JULY
A	19	4	12	21	24
B	21	6	12	21	
C			12	18	28
D			12		
E			12		
F			14.5		
G	22	10	13	22	24
H			15	21	22
I	22	6	15	21	27
J			19		23
K			19	21	23
L			16		

Table 3-2. Number of each fish species caught (retained and released combined) at each of the 12 sampling sites.

	SAMPLING SITES											
	A	B	C	D	E	F	G	H	I	J	K	L
Number of Times Sampled	5	3	3	1	1	1	6	4	5	2	4	1
AMIIDAE												
Bowfin *Amia calva*							1		1		1	
ESOCIDAE												
Northern pike *Esox lucius*	8			5	2	5	26	2	6		14	
UMBRIDAE												
Central mudminnow *Umbra limi*	6		1	4	1	2	63	7	4	5	20	
CYPRINIDAE												
Carp *Cyprinus carpio*	3	2	9	1		6	4	2	24		5	
Golden shiner *Notemigonus chrysoleucas*	5	1		24	16	26	182	20	95	18	320	13
Common shiner *Notropis cornutus*	10	8		5		2		1				
Bigmouth shiner *N. dorsalis*	9											
Blackchin shiner *N. heterodon*						1			1		1	
Spotfin shiner *N. spilopterus*	29	9		81	3	14		196	67			
Sand shiner *N. stramineus*	175	26		17		1		60	4			
Northern mimic shiner *N. volucellus volucellus*	1											
Bluntnose minnow *Pimephales notatus*	28	38			1	7		13	1			
Fathead minnow *P. promelas*	3	12	1	27	8	5	2	8	4		45	
Creek chub *Semotilus atromaculatus*	2							4				
CATOSTOMIDAE												
White sucker *Catostomus commersoni*	17	1		1				2				
Lake chubsucker *Erimyzon sucetta*							4					
ICTALURIDAE												
Black bullhead *Ictalurus melas*	7	18	12	2	1	8	34	3	18	7	170	1

Table 3-2 cont.

	SAMPLING SITES											
	A	B	C	D	E	F	G	H	I	J	K	L
Yellow bullhead *Ictalurus natalis*	5	3		2			1	4				
Tadpole madtom *Notorus gyrinus*	4	5	1			10	12		3	6	1	
CYPRINODONTIDAE												
Blackstripe topminnow *Fundulus notatus*	22	3		11	7	14		27	20			
GASTEROSTEIDAE												
Brook stickleback *Culaea inconstans*	3						7	5	1	1	1	
CENTRARCHIDAE												
Green sunfish *Lepomis cyanellus*	25	17	3	10	9	32	21	54	49	17	30	23
Pumpkinseed *L. gibbosus*		2				3	21	1	13	30	57	9
Warmouth *L. gulosus*	2								1			
Bluegill *L. macrochirus*	7		2	1	2	14	302	46	37	113	91	11
Largemouth bass *Micropterus salmoides*							10		1			
White crappie *Pomoxis annularis*			1	2			1		1			
Black crappie *P. nigromaculatus*	4	5	1	2	6	4	44	2	50	5	260	2
PERCIDAE												
Yellow perch *Perca flavescens*						2						
Iowa darter *Etheostoma exile*			1			1	22	3		4	1	1
Johnny darter *Etheostoma nigrum*	49	49				1		15	1			
Blackside darter *Percina maculata*	12	26						21				
TOTAL NUMBER OF SPECIES	24	17	10	16	11	20	17	22	21	10	15	7

Table 3-3. Evidence supporting the reproduction of fish species within the Project Area. Occurrence listed by sampling site letters.

SPECIES	GRAVID FEMALE	RIPE MALE	JUVENILE
Bowfin			K
Northern pike*		G	D,F,G,I
Central mudminnow	G		G
Carp		F	C,G
Golden shiner		A	G
Spotfin shiner	H	I	A
Sand shiner			A
Creek chub			A
White sucker		A	A,H
Black bullhead*	K		G,J
Blackstripe topminnow	H,I		
Brook stickleback			A,G
Pumpkinseed*		G	
Bluegill*	K	G	G
Largemouth bass*			G
Black crappie*		K	K
Iowa darter	L		C,G,K
Johnny darter	B	B	A
Blackside darter			A,H

* Game species.

Table 3-4. Fish species recorded for the Des Plaines River in Wisconsin by Greene (1935) but not collected in the present survey, and those collected in the present survey but not recorded by Greene.

SPECIES RECORDED BY GREENE BUT NOT COLLECTED IN 1979-80	SPECIES COLLECTED IN 1979-80 BUT NOT RECORDED BY GREENE
Erimyzon oblongus	*Cyrpinus carpio*
Nocomis biguttatus	*Notemigonus chrysoleucus*
Notropis texanus	*Notropis dorsalis*
Notropis heterolepis	*Notropis heterodon*
Notropis umbratilis	*Notropis spilopterus*
Esox vermiculatus	*Notropis stramineus*
Microperca punctulata	*Notropis volucellus*
*Lepomis megalotis**	*Pimpehales promelas*
Ambloplites rupestris	*Erimyzon sucetta*
	Ictalurus melas
	Culaea inconstans
	Esox lucius
	Ethostoma exile
	Lepomis macrochirus
	Lepomis gulosus
	Pomoxis annularis

* Now on the Wisconsin Threatened Species List.

Table 3-5. Fish species found in the Des Plaines River in Wisconsin but not in Lake County, Illinois, and vice versa.

FISH SPECIES TAKEN IN WISCONSIN BUT NOT IN ILLINOIS	FISH SPECIES TAKEN IN ILLINOIS BUT NOT IN WISCONSIN
Bowfin *Amia calva*	Goldfish *Carassius auratus*
Central mudminnow *Umbra limi*	Pugnose shiner *Notropis anogenus*
Bigmouth shiner *Notropis dorsalis*	Lake emerald shiner *Notropis atherinoides*
Blackchin shiner *Notropis heterodon*	Redfin shiner *Notropis umbratilis*
Mimic shiner *Notropis volucellus*	Lake chub *Couesius plumbeus*
Creek chub *Semotilus atromaculatus*	Hornyhead chub *Nocomis biguttatus*
Lake chubsucker *Erimyzon sucetta*	Redhorse *Moxostoma* sp.
Blackstripe topminnow *Fundulus notatus*	Spotted sucker *Minytrema melanops*
Brook stickleback *Culaea inconstans*	Channel catfish *Ictalurus punctatus*
Warmouth *Lepomis gulosus*	Yellow bass *Morone mississippiensis*
White crappie *Pomoxis annularis*	Rock bass *Ambloplites rupestris*
Yellow perch *Perca flavescens*	
Iowa darter *Etheostoma exile*	

Table 3-6. Wisconsin threatened and endangered fish species (from DNR listing).

ENDANGERED	THREATENED
Gravel chub *Hybopsis x-punctata*	Goldeye *Hiodon alosoides*
Striped shiner *Notropis chrysocephalus*	Speckled chub *Hybopsis aestivalis*
Slender Madtom *Noturus exilis*	Pallid shiner *Notropis amnis*
Starhead topminnow* *Fundulus notti*	Blue sucker *Cycleptus elongatus*
Crystal darter *Ammocrypta asprella*	Black buffalo *Ictiobus niger*
Gilt darter *Percina evides*	River redhorse *Moxostoma carinatum*
Bluntnose darter *Ethecstoma chlorosomum*	Longear sunfish *Lepomis megalotis*
	Mud darter *Ethostoma asprigene*
	Pugnose shiner *Notropis anogenus*
	Ozark minnow *Dionda nubila*

* Presumably the Northern starhead minnow, now recognized as *Fundulus dispar* (Agassiz).

PART 4: INVERTEBRATE INVENTORY AND HABITAT EVALUATION

Carl von Ende, Ph.D.

INTRODUCTION

This report describes a survey of the wetland area associated with the Des Plaines River near Pleasant Prairie, Wisconsin (Pleasant Prairie Quadrangle, Kenosha Co., T1N, R22E, Sections 7, 18, 19, 20, 29, 30, 32).

METHODS

The area was sampled three times in the summer of 1980, although not all sampling sites were visited each time. For convenience, the sites were assigned a letter from A to K, and will be referred to accordingly (Fig. 4-1). These are the same designations used in the fish survey (Part 3). All sites were sampled during the period 3-5 June. In addition, sites C and G were sampled during 6-11 June, and site G was sampled again on 12 July. Samples from all dates were combined prior to analysis.

The wetland area generally consists of three kinds of aquatic habitats: 1) the Des Plaines River proper; 2) marshlands adjacent to the river; and 3) deep manmade canals that may drain into the river. Sites A, B, D, F and I were river sampling sites. Sites G and H were in marshy areas, and C, E and K were along the canals. Part of site G was a canal that overflowed into the marshland.

Because of the variety of habitats and the large area to be covered, all sampling was done with Turtox triangular nets. Sampling focused on the macroinvertebrates in the benthos and those associated with the aquatic vegetation. Samples from the muddy areas of the river were washed in the field through a series of three sieves, with the smallest having a 500-μm screen. The contents of each sieve were dumped into a white enamel pan for sorting. Invertebrates from the riffles area of the river were collected by dislodging rocks in front of the submerged net, and by picking the animals off the rocks. Those collected in the net were sorted in a white enamel pan. Bottom samples collected from the marshes and canals also were run through the sieves and sorted in the pans. Samples from the vegetation were sorted in pans.

Sampling period duration at each site depended on the abundance and diversity of the fauna. Sampling was continued until 25-50 organisms of the more abundant taxa were collected, or until field identification of the major taxa indicated that we had a representative sample. The number of locations actually sampled within a site corresponded with the sizes of the respective sites. Consequently, sampling time per site ranged from 0.5-7.0 hours (Table 4-1). All crayfish reported in the Results were captured by Dr. Greenfield while seining for fish.

All organisms were preserved in 75% ethanol in the field and returned to the laboratory for identification. The following taxonomic keys were used for identification of the organisms: Baker (Ref. 1), Burch and Patterson (Ref. 2), Edmunds et al. (Ref. 3), Flowers and Hilsenhoff (Ref. 4), Harman and Berg (Ref. 5), Hilsenhoff (Ref. 6), Hobbs (Ref. 7), Mathiak (Ref. 8), Mason (Ref. 9), McCafferty (Ref. 10), Pennak (Ref. 11), Spieth (Ref. 12), and Van der Schalie (Ref. 13). All taxa were identified to as low a category as possible. In the case of crayfish, only Form I males could be identified, as the modified appendages present during reproduction are essential to accurate identification. All specimens have been placed in the freshwater invertebrate collection at Northern Illinois University.

For the riffles area of the river, a Biotic Index (Ref. 14) was calculated. It is defined as:

$$\text{B.I.} = n_i a_i / N \text{ , where}$$

n_i = the number of individuals of genus or species i,

a_i = the biotic index value assigned to genus or species i,

N = the total number of individuals collected.

Hilsenhoff (Ref. 14) has assigned biotic index values to genera and species of aquatic arthropods on the basis of extensive collections in Wisconsin. Where values were not available for the genus, but only for individual species, the average value was used. The values for genera or species range from 0 to 5; 0 depicting species collected only in unaltered streams of very high water quality, and 5 depicting species at the opposite extreme that are known to occur in severely polluted or disturbed streams. Because the taxa do demonstrate habitat fidelity, the Biotic Index can be used as an estimate of habitat quality.

Description of Sampling Sites

The general characteristics of the habitat at each sampling site and the areas sampled are presented to aid in the interpretation of the results. At Site A (Fig. 4-1), the river has a very sandy substrate with no detectable fine silt, detritus, or rocks. Only the bottom sediments of the river were sampled. The sand seemed to be carried in from a tributary entering from the north. The substrate at Site B is rocks on a firm bottom, and both are covered with a very fine silty mud. In some places the mud is 15 centimeters deep. Because of the lack of vegetation on the sides of the river, only the middle was sampled. The canal at Site C has a thick mucky bottom of fine silt. The bottom and the sides were sampled. The river at Site D is narrow and fast flowing, but again the bottom is a fine silty mud with some clay. There is overhanging grass on the undercut west side of the river and a few aquatic plants on the shallower east side. All three areas were sampled. Site E is similar to Site C and was sampled similarly. Site F resembles Site D and consequently the same three types of areas were sampled. At the southern end of F, however, conditions vary slightly. The river widens and rooted vegetation occurs along the west side. The middle and the west side were sampled at this location.

Site G is a large marshy area with an adjoining canal. The marshy area was sampled at five different locations, including the sides of the deep canal. The bottom of the canal was not sampled. The sediments of the marsh are composed of decaying plant matter. At Site H the river is narrow and there is a short riffle area with a rocky substrate. The riffles were sampled as well as a 50-meter stretch upstream and downstream. About 0.5 kilometers south of the riffles, the river sediments are not completely composed of the fine silty mud as at Sites B and D, but have a fair proportion of sand. The channel of the river was sampled in this area. At Site I the river is very wide. Again the sediments are a fine silty mud. Both the sides and the middle of the river were sampled near the bridge across County Highway ML, and 0.6 kilometer north of the bridge. At Site J there is a marshy area with a large amount of open water. The benthos and macroinvertebrates associated with the rooted aquatic vegetation were sampled at the border of the vegetation and the open water. As at Site G, the sediments consist of decaying plant matter. The sides and fine silt sediments of the canal at Site K also were sampled.

RESULTS

The only invertebrates collected at Site A (Fig. 4-1) were crayfish of the genera Orconectes and Procambarus (total of 3 individuals, Table 4-1). No aquatic insects were found. The burrowing mayfly Hexagenia limbata was the only taxon present at Site B, but it was abundant, with 43 specimens being collected in about 0.75 hours of sampling

(Table 4-1). The canal at Site C yielded eight taxa (n=29), but all except two taxa were relatively rare (Table 4-1). The mayflies present were *Paraleptophlebia* spp. and an unidentifiable member of the same family. The damselflies were *Enallagma* spp. and *Lestes* spp. The gastropods present were *Lymnaea (Pseudosuccinae) columella*, *L. (Fossaria) modicella*, and *Physa gyrina*. All these taxa were associated with the vegetation on the sides of the canal, including the immature Corixidae, which was the most abundant taxon, and the midge *Chironomus* spp.

At Site D, *Hexagenia limbata* was the only invertebrate in the river channel sediments. It was not as abundant as at Site B (18 individuals in 0.75 hours of sampling, representing 40% of the sample; Table 4-1). The other taxa found were associated with the overhanging vegetation on the sides of the river: the damselfly *Enallagma* spp. (11%), immature corixids (29%), and one specimen of each of the beetles *Dineutus* spp. and *Peltodytes* spp. Six juveniles and one Form II male crayfish were captured in fish seines.

At the second canal, Site E, only two individuals of the mayfly *Caenis* spp. were found in 0.5 hour of sampling the vegetation and the sediments (Table 4-1). Three crayfish were found in seining, one male *Procambarus* spp. and two females.

Site F was similar to Site D in habitat and fauna, except it had a few less taxa. *Hexagenia limbata* was most common and about as abundant at the northern part of Site F (11 in 0.5 hr sampling, 50% of sample; Table 4-1) as at Site D. Only one specimen of *Hexagenia* was found in the southern part of Site F. Again, *Enallagma* spp. (1 individual) and immature corixids (6 individuals) were associated with the vegetation on the sides of the river. One snail (*Physa* spp.) and two chironomids also were found.

The marshlands at Site G clearly have the most diverse and extensive invertebrate fauna of the areas sampled. A total of 56 taxa were found in about 7 hours of sampling (Table 4-1). Of the 800 specimens collected, the most abundant taxa were the mayfly *Caenis* spp. (14%), the amphipod *Hyalella azteca* (13%), and the damselflies *Enallagma* spp. (12%) and *Lestes* spp. (9%). Other rather common arthropods were corixids (6%), the dragonflies *Anax* spp. (2%) and *Sympetrum* spp. (2%), and the isopod *Asellus* spp. (3%). Both beetles and chronomid midges had relatively diverse faunas, although no one taxon was very abundant. Thirteen genera of beetles and nine genera and one tribe of chironomids were collected, but none had greater than ten individuals. Other dipternas were robber fly (*Odontomyia* spp.) larvae and crane-fly (*Prionocera* spp.) larvae. It was striking that there was also a diverse snail fauna (11 species, 120 individuals). *Lymnaea (Stagnicola) umbrosa* (28% of snails), *Physa sayii* (34%) and *Gyraulus hirsutus* (9%) were the most abundant species. There were four other species of *Lymnaea* and two of *Physa*, in addition to the planorbid species *Helisoma trivolvis*. The small bivalves *Musculium* spp. and *Sphaerium* spp. were present also, as were a few oligochaetes. Besides corixids, the other hemipterans present were the predaceous genera *Belostoma*, *Gerris*, *Ranatra*, and *Notonecta*. Twenty-two crayfish were found, of which four were identifiable Form I males (3 *Orconectes* spp. and 1 *Procambarus* spp.). Twelve females were included in the sample also.

In about one hour of sampling, the riffles area at Site H yielded the second most diverse fauna in the river (15 taxa, excluding the bivalves and *Hexagenia*). Of the 146 specimens, the mayflies *Baetis* spp. (26%) and *Caenis* spp. (25%) were the most abundant taxa followed by blackfly larvae *Simulium* spp. (15%) and the beetles *Stenelmis* spp. (12%) (Table 4-1). This was the only site at which *Simulium* was found. No *Hexagenia limbata* were found in the riffles. The only specimen was found in the area south of the riffles. The three caddisfly pupae (Hydropsychidae) and the 13 empty cases indicate this caddisfly family probably is more common, but was rare because most of the larvae had pupated and the pupae had emerged by the time of sampling. Five genera of chironomids were found in the riffles (*Cryptochironomus*, *Dicrotendipes*, *Einfeldia*, *Polypedilium*, and *Cricotopus*), but none had more than six individuals. The only specimen of *Hexagenia limbata* at Site H also was found in this area. The Biotic Index for the riffles is 3.17. The southern part of Site H was unique because it was the only location in the river at which live unionid clams were found. We collected 15 specimens of *Anodonta grandis* (the Floater) and seven of the large *Lasmigona complanta* (the White Heel Splitter) in 1.5 hours of sampling. The only Wisconsin invertebrate on the Federal or State endangered or threatened species lists is the Higgins Eye Pearly Mussell (*Lampsilis higginsi*). It does not occur within the Project Area.

The wide area of the river at Site I yielded 30 taxa in 3 hours of sampling (Table 4-1). According to the results, the most common taxon was the immature corixids (53%, n=320). This finding, however, is biased because the corixids were collected in a swarm in a shallow area of the river near the shore. Normally, they were distributed about the same as the smaller groups. Of the remaining organisms (n=152), the mayflies *Baetis* spp. (29%), *Hexagenia limbata* (19%), and *Caenis* spp. (6%) were the most common. Other mayflies present were *Heptagenia diabasia* and *Stenacron interpunctatum*. *Hexagenia* was found in the muddy sediments in the middle of the river, whereas the other mayflies were found at the base of the rooted aquatic macrophytes on the sides of the river. Four individuals of the damselfly *Enallagma* spp. were present.

There were five genera of beetles present (*Hygrotus* or *Hydroporus*, *Stenelmis*, *Dineutus*, *Gyrinus*, and *Enochrus*), and a member of the Noteridae, as well as five genera of chironomids (*Cryptochironomus*, *Cardiocladius*, *Cricotopus*, *Procladius*, and *Tanypus*). Except for *Cricotopus* all were represented by fewer than three individuals. They were associated with the aquatic vegetation on the sides of the river. Three species of snails (*Lymnaea* (*Fossaria*) *modicella*, *Gyraulus hirsutus*, and *Helisoma trivolvis*) were present in the same habitat with the bivalve *Sphaerium* spp. (all less than 3 individuals). Fourteen crayfish were found, but only two Form I males were identifiable (1 *Orconectes* spp. and 1 *Procambarus* spp.).

The invertebrate fauna at Site J was similar to that at Site H, but much less diverse (17 taxa). Of the 68 specimens collected in 1 hour of sampling, 26% were the amphipod *Hyalella azteca*, 13% the mayfly *Caenis* spp., and 13% the damselfly *Enallagma* spp. (Table 4-1). Two individuals of another damselfly, *Lestes* spp., also were found. Two new taxa of hemipterans were present: *Mesovelia* spp. (water treaders, 4%), and *Neoplea stiola* (pygmy backswimmer, 9%). The following taxa were present at Site J but represented by two or fewer individuals: beetles - *Peltodytes* spp. and *Tropisternus* spp.; chironomids - *Parachironomus* spp., *Procladius* spp., and *Tanypus* spp.; crane-fly larva - *Prionocera* spp.; snails - *Helisoma trivolvis* and *Promenetus exacuous*; dragonfly - *Plathemis lydia*; oligochaetes; and leeches.

Site K had the same number of taxa as Site J. Of the 80 specimens collected in 1 hour of sampling, *Neoplea striola* was the most abundant (26%) followed by *Hyalella azteca* (19%), *Caenis* spp. (14%) and *Peltodytes* spp. (10%). *Enallagma* spp. comprised only 6% of the sample. The other beetle present was *Hygrotus* spp. (1 individual). There were four species of snails (*Lymnaea palustris elodes*, *Physa sayii*, *Gyraulus hirsutus*, and *Helisoma trivolvis*). Each of the first three were represented by only one individual, whereas three specimens of the latter were collected. The remaining taxa were *Chironomus* spp., Gerridae, *Procambarus* spp., *Musculium* spp., and oligochaetes; each represented by one to three individuals.

HABITAT EVALUATION BASED ON THE INVERTEBRATE FAUNA

The three major wetland habitats (river, canal, marsh) show both similarities and differences in their faunas. The number of taxa found at a site varies from 1-30 in the river, 2-17 among the canals, and are 17 and 56 for the marshes. This is typical for similar habitats at other locations in the Upper Midwest. At the Des Plaines River wetland sites, taxonomic diversity generally is correlated with habitat diversity. Sites with more diverse habitats created by added physical structure, in the form of rocks in riffles and rooted aquatic vegetation in the river and marshes, also were the ones with the largest number of taxa. This added physical structure provides a greater variety of microhabitats for the aquatic invertebrates.

Except at Sites A, H, and the lower part of F, the sediments of the channel of the river were dominated (usually 100% of fauna) by the burrowing mayfly Hexagenia limbata. At all these sites (B, D, upper part of F, I), the substrate was composed of a soft silty mud with some clay. Hexagenia prefers this kind of substrate (Ref. 3). Because the nymphs build burrows in mud, they are largely restricted to a substratum that is soft, yet firm enough to permit maintenance of burrows (Ref. 3). Ordinarily they do not inhabit sand, gravel, rubble, or peat bottoms that are flocculent. Walder and Burbauck (Ref. 15) reported that Hexagenia munda never was found in a substrate containing more than 55% sand by weight. Apparently, substrates that were too sandy would not support the establishment of burrows. This would appear to explain the absence of H. limbata from the sandy Site A, and its scarcity at the lower part of Site H, where the substrate contained more sand. Also, the peaty bottoms of the marshes probably are too flocculent and contain too much coarse plant matter.

With the exceptions of Site H and crayfish, the taxa at river sites were associated with the shore or the overhanging vegetation and the rooted aquatic vegetation along the sides of the river channel. The large amount of rooted aquatic vegetation at Site I may account for the large number of taxa at this site. The structuring of the environment by the plants provides good habitat for mayflies (Caenis spp. and Baetis spp.), beetles, midges, damselfly nymphs, and snails.

The greater diversity at Site H undoubtedly is the result of the added habitat complexity caused by the riffles. The rocks provide good habitat for the mayfly taxa other than Hexagenia, and for chironomids, blackfly larvae, and caddisflies.

Generally, bivalves prefer stable gravel, sand, and substrates composed of sand or gravel mixed with other materials. Although soft mud bottoms are usually uninhabited, there are some "mud loving" Anodonta species (Ref. 11). It appears the proportion of sand in the substrate at the lower part of Site H is an acceptable mixture for the two species of unionid clams we found. This was the only site that had this kind of substrate and also had unionid clams. Both species are widespread in Wisconsin, but Lasmigona complanta (one of the largest clams in Wisconsin) is most abundant east of a line from Green Bay to Beloit (Ref. 8). Anodonta grandis is known to tolerate a wide variety of habitats (Ref. 8). The absence of macroinvertebrates other than crayfish from Site A probably is due to the absence of organic matter from the substrate and larger rocks and pebbles that provide refuges and sites of attachment for aquatic insects.

The high taxonomic diversity in the marsh at Site G most likely is the result of the high diversity of micro-habitats provided by the vegetation in this aquatic environment, and the large amount of both live and decaying plant matter available to support a complex community of herbivores, detritivores, and predators. The snail fauna was the most diverse of all sites. It is unclear why the marshy area of the lake at Site J had a less complete fauna, but more intense fish predation or consistently deeper water may be important factors. The mayfly *Caenis* spp. was common in the marsh areas as well as at river Sites H and I. Merritt and Cummins (Ref. 16) described this genus as occurring in depositional lotic habitats (running waters) as well as in the littoral sediments of lentic habitats.

Except for Site K, the canals had a low number of taxa, and none of the taxa were unique. The canal faunas represent small subsets of the marsh faunas because all the taxa in the canals also were present in the marshes. There were no apparent differences in the canals that would explain the greater number of taxa at Site K, except that the canal at Site C does receive effluent from the Pleasant Prairie sewage treatment plant. A longer sampling period may have yielded a few more taxa at Site E. The lower diversity in the canals probably, in part, is due to the reduced structural diversity in the canals. The vegetation along the sides of the canals provide much less structural diversity than the rooted aquatic plants in the marshes. Also, the sediments of the canals were a very fine sandy silt, rather than coarse decaying plant matter as in the marshes.

Comparison of the results from this study with those from one conducted on the Des Plaines River in Lake County, Illinois (Ref. 17) shows that there are several differences. Firstly, oligochaetes and chironomids were the most common benthic organisms found in Lake County. We reported only a few from the Kenosha section of the river. This difference may reflect variations in water quality, river habitats, or in the sampling techniques. Our mesh size for the screens may have been too large for oligochaetes, but we should have detected the chironomids if they were abundant. The thick consistency of the muddy substrate may be unsuitable for these taxa. The second difference is that the Illinois study produced several genera of caddisflies (*Psychomyia*, *Leptocerus*, and *Macronemum*) and mayflies (*Baetisca*, *Potomanthus*, and *Ephoron*) that we did not find. Except for *Ephoron*, these genera tended to be found at sites with high percentages of gravel and rock in their substrates. This kind of substrate was rare in our study areas.

In conclusion, based on the macroinvertebrate fauna in the riffles and in the sediments of the river channel, the Des Plaines River in the Kenosha Project Area can be classified as having fair to good water quality, i.e. moderate to some enrichment or disturbance. A Biotic Index value of 3.17 for the riffles is on the border between fair and poor water quality (Ref. 14). However, Hexagenia limbata, which was the taxon found at the most sites in the river, has a Biotic Index value of 2. This falls within the "good" water quality range. Apparently the main factors limiting the diversity of aquatic insects in the river are: 1) the high silt load; 2) the lack of rocky riffle habitats; and 3) possibly effluent from the sewage treatment plant and other point sources of pollution. The dominance of Hexagenia, however, is beneficial to the fish community in the river and to the bird communities in surrounding habitats. Because H. limbata nymphs can be very large (up to 30 cm in length), they can be important prey items for fish. Emerging adult Hexagenia also represent an important food source for birds when large emergences occur. Consequently, the abundance of this species that is adapted to the existing river conditions may be of paramount importance in the food chain of vertebrate species using the wetlands.

A ranking of the sites by number of taxa and abundance of organisms shows that, with the exception of Site I, those sites with the greater diversity also had the most organisms (Table 4-2). These were the marshy areas, the canal at Site K, and the riffles area of the river. Site B ranked highest among the remaining sites in terms of abundance because of the presence of Hexagenia. All but one (Site B) of the higher quality sampling sites (as indicated by abundance and diversity of taxa) (Fig. 4-1), are concentrated in the southern half of the Project Area (Sites G, K, J, H and I). Although Site L was not sampled, the substrate characteristics indicate that it would be similar to Site J. This diverse fauna is important in its own right, and because it forms the food base for vertebrate species occurring in the wetlands habitat.

The list of taxa provided here is not exhaustive and undoubtedly more invertebrate taxa would be found if more extensive sampling was conducted. In particular, more mayfly, caddisfly, and midge taxa are likely to occur in the riffles area of the river. Other species of clams may exist locally at other locations on the river. Crayfish mounds were common in many areas along the river banks although, as our results indicate, they were difficult to capture. Zooplankton species also are present in the river, as shown in the Lake County study (Ref. 17). In addition, the marsh areas could yield more genera and species of dragonflies, damselflies, beetles, hemipterans, midges, other dipterans, and gastropods, as well as littoral zooplankton species.

The invertebrate fauna expected for the Project Area is apt to be more diverse than indicated by this study. Nevertheless, the diversity of species and abundance of individuals documented by this study are sufficient to show: 1) that water quality is sufficiently good to maintain a diversified invertebrate fauna; and 2) that the abundance of invertebrates is adequate to maintain substantial populations of terrestrial and aquatic vertebrates.

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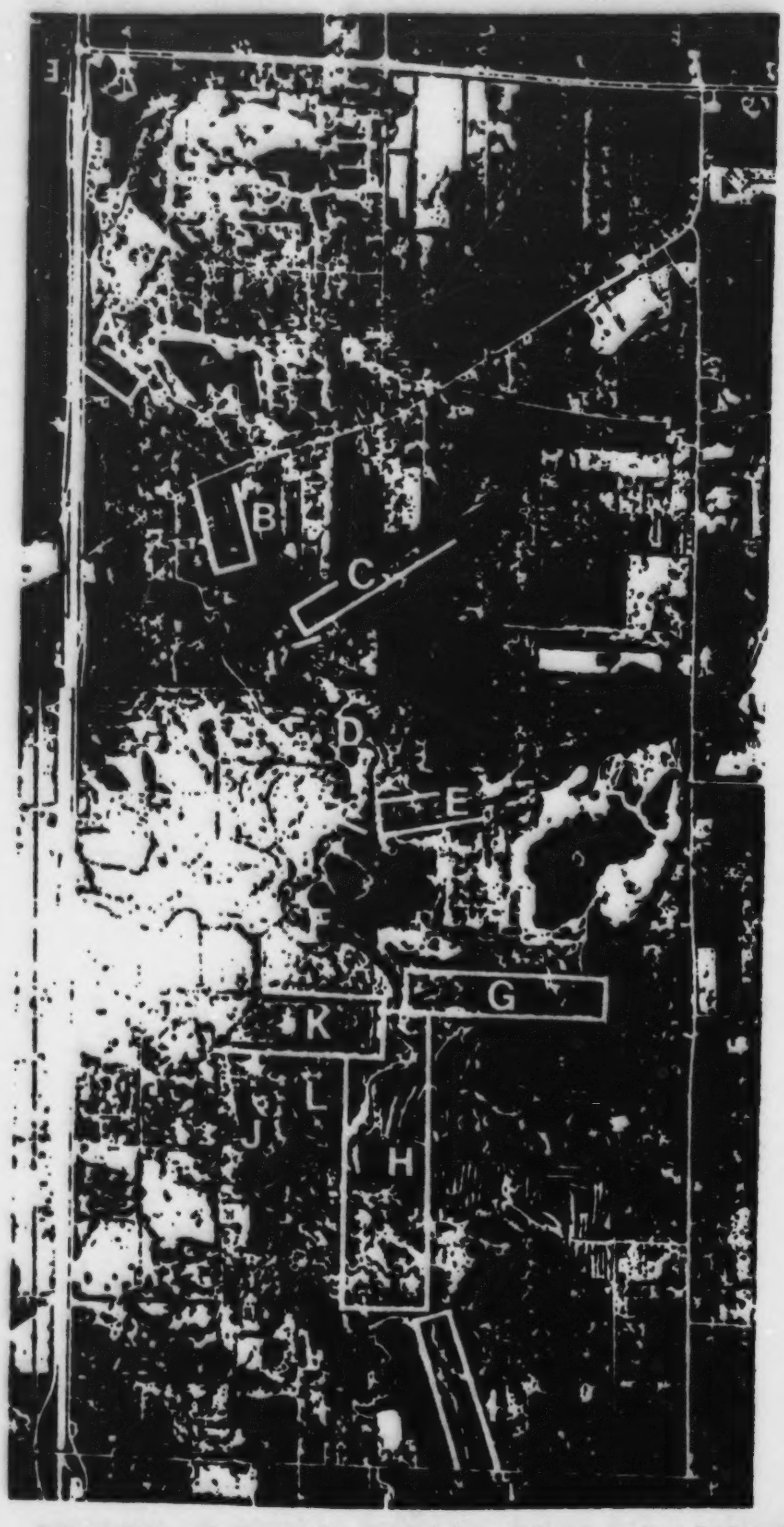
A
B
C
D
E
G
K
L
J
H

Figure 4-1. Location of Aquatic Sampling Sites A-L visited during invertebrate studies.

Table 4-1. Macroinvertebrate fauna of Des Plaines River wetlands for 11 sampling sites; also sampling time, abundance of taxa, total number of taxa, and total number of organisms at each site.

	SITES										
	A	B	C	D	E	F	G	H	I	J	K
Sampling Time (hr)	0.5	0.75	1.0	0.75	0.5	0.5	7.0	2.5	3.0	1.0	1.0
INSECTA											
Ephemeroptera											
Baetidae											
Baetis spp.							6	38	44		
Unidentifiable							1				
Caenidae											
Caenis spp.					2		110	37	9	9	11
Ephemeridae											
Hexagenia limbata		43		18		12		1	29		
Heptagenidae											
Heptagenia diabasia								1	5		
Stenacron interpunctatum								1			
Leptophlebiidae											
Paraleptophlebia spp.			2						1		
Unidentifiable			1								
Odonata											
Coenagrionidae											
Enallagma spp.			2	5		1	97		4	9	5
Lestidae											
Lestes spp.			1				73			2	
Aeshnidae											
Anax spp.							19				
Libellulidae											
Plathemis lydia									1		
Sympetrum spp.							19				
Unidentifiable											1
Hemiptera											
Belostomatidae											
Belostoma spp.							2				
Immature							1				
Corixidae											
Trichocorixa spp.							12		7		
Immature			12	13		6	38		174		
Gerridae											
Gerris spp.							1		1		
Immature							5				3
Mesoveliidae											
Mesovelia spp.										3	
Nepidae											
Ranatra spp.							1				
Notonectidae											
Notonecta spp.							4				

Table 4-1 cont.

	SITES										
	A	B	C	D	E	F	G	H	I	J	K
Notonectidae (cont.)											
Immature							3				
Pleidae											
Neoplea striola										6	21
Trichoptera											
Hydropsychidae											
Pupa								3			
Cases								13			
Coleoptera											
Dytiscidae											
Colymbetes sp.							1				
Coptomus sp.							1				
Graphoderus sp.							1				
Hygrotus or *Hydroporus* spp. (larvae)							11		1		
Hygrotus spp. (adults)							4				1
Elmidae											
Stenelmis spp.								18	1		
Unidentifiable							2				
Gyrinidae											
Dineutus spp.				1			1		3		
Gyrinus							1		1		
Haliplidae											
Haliplus spp.							3				
Peltodytes spp.				1			2			1	8
Hydrophilidae											
Enochrus spp.							9		2		
Hydrobius sp.							1				
Hydrocara sp.							1				
Tropisternus spp.							2			1	
Noteridae											
Unidentifiable									1		
Diptera											
Chironomidae											
(Chironominae)											
Chironomus spp.			4				10				2
Cryptochironomus spp.						1		2	1		
Dicrotendipes sp.								1			
Einfeldia sp.								1			
Endochironomus spp.							2				
Geoldichironomus spp.							3				
Kiefferulus spp.							3				
Microspectra sp.							1				
Parachironomus spp.							1			2	
Polypedilum spp.								4			

Table 4-1 cont.

	SITES										
	A	B	C	D	E	F	G	H	I	J	K
Chironomidae (cont.)											
(Orthocladinae)											
Cardiocladius spp.							19		1		
Cricotopus spp.							1	6	8		
Psectrocladius sp.							1				
(Tanypodinae)											
Procladius spp.									1	1	
Tanypus spp.									1	1	
Pentaneurini (tribe)							6				
Unidentifiable chironomids						1	8	3			
Simuliidae											
Simulium spp.								22			
Stratiomyidae											
Odontomyia spp.							5			7	
Tipulidae											
Prionocera spp.							11			2	
Unidentifiable pupae							3				
CRUSTACEA											
Amphipoda											
Talitridae											
Hyalella azteca							100		1	18	15
Isopoda											
Asellidae											
Asellus spp.							27	1			
Lirceus sp.							1				
Decapoda											
Astacidae											
Orconectes spp.	3						3	3	1		
Procambarus spp.	1				1		2	1	1		1
Unidentifiable males				1			5	2	2		
Females	2				2		12		11		
Juveniles				6							
MOLLUSCA											
Gastropoda											
Lymnaeidae											
Lymnaea (Pseudosuccinea) columella			1				4				
Lymnaea (Stagnicola) lanceata							4				
Lymnaea (Fossaria) modicella			1						4		
Lymnaea palustris elodes							5				1
Lymnaea (Fossari) parva							1				
Lymnaea (Stagnicola) umbrosa							34				
Lymnaea spp. (immature)							11		1		1
Physidae											
Physa ancillaria							1				
Physa gyrina			1				1				

Table 4-1 cont.

	SITES										
	A	B	C	D	E	F	G	H	I	J	K
Physidae (cont.)											
Physa sayii							41				1
Physa spp. (immature)			1			1	1		1		
Planorbidae											
Gyraulus hirsutus							9		2		1
Gyraulus spp. (immature)							4				
Helisoma trivolvis							4		1	1	3
Promenetus exacuous										1	
Bivalvia											
Sphaeridae											
Musculium spp.							13				3
Sphaerium spp.							1		3		
Unionidae											
Anodonta grandis								15			
Lasmigona complanata								7			
Oligochaeta			3				10	2	2	2	2
Hirudinea										2	
Total number of taxa	2	1	8	6	2	5	56	18	30	17	17
Total number of individuals (excluding crayfish)	0	43	29	38	2	22	778	163	311	68	79
Number of individuals/0.5 hr sampling (excluding crayfish)	0	29	15	25	2	22	56	73*	23†	34	40

* Estimate only for riffles (n=146).
† Corixids excluded in this estimate.

Table 4-2. Ranking of sites in decreasing order for number of taxa and number of individuals/0.5 hr sampling. Based on data in Table 4-1.

NUMBER OF TAXA	ABUNDANCE
G	H
I	G
H	K
J	J
K	B
C	D
D	I
F	F
E	C
A	E
B	A

PART 5: INVENTORY OF AMPHIBIANS, REPTILES AND MAMMALS

William E. Southern, Ph.D.

INTRODUCTION AND METHODS

Concomittant with the bird inventories, the ornithological team recorded each sighting of representatives of the other vertebrate groups. In addition, a census of muskrat houses was conducted on Survey Areas 1, 2, 4, and 5. Scientific names for the animals mentioned in the text are found in Tables 5-1 and 5-3.

RESULTS

Amphibians

Five species of amphibians were identified on the Project Area (Table 5-1). Frogs were observed frequently in Survey Areas 1, 2 and 4, and occasionally in the other survey areas. American toads inhabited upland sites but bred in the wetlands. A single tiger salamander was recorded in Survey Area 1. It is likely that all five species of amphibians completed their life cycles in various portions of the Project Area. No threatened or endangered amphibians were recorded on the Project Area (Table 5-2).

Since these forms are dependent upon a variety of aquatic organisms as food during their larval and adult stages, their presence is another indication that the invertebrate fauna is sufficiently productive to support a diversified vertebrate fauna. Amphibians, in turn, provide food for various fishes, reptiles, birds and mammals.

Reptiles

Five species of reptiles were observed on the Project Area (Table 5-1): four kinds of turtles and one snake species. Turtles were recorded on numerous occasions, particularly in Survey Areas 1 and 2. The Blanding's turtle, a State Threatened Species (Table 5-2) was recorded on at least five occasions. Two of the sightings were about 1.6 kilometers apart, thereby increasing the likelihood that they were different individuals. Each of the Blanding's turtles we observed was considered to be adult size. A female was found in a upland area near the entrance road to the Pheasant Valley Hunting Club where it may have been preparing to lay eggs. One Blanding's turtle was captured and photographed on Survey Area 1.

Mammals

Thirteen species of mammals were recorded on the Project Area (Table 5-3). None of these appear on the State Threatened or Endangered Species Lists (Table 5-2). Several of these species are characteristic of wetland habitats. The activities of beaver and muskrat influence the wetland area in a variety of ways. Both species burrow in banks, such as dikes, thereby reducing their water holding capacity. In addition, beaver may cut wide canals through earthen dams and dikes. This has been accomplished by beaver at two locations along the "Q" dike and other cuts have been started. Construction of these deep cuts has permitted water to flow from the canals back into the wetlands that they drain. The higher and more persistent water levels observed in Survey Areas 1 and 4 during 1980 were, in part, influenced by beaver activity.

Beaver and muskrat also eat marsh vegetation. Muskrats are important consumers of cattails, sedges and other forms of emergent marsh vegetation. Their activities influence the rate at which marsh plants close off the open pools that are essential to many marsh birds. The persistence of a healthy muskrat population is an important factor contributing to habitat quality for many bird species. Besides cutting vegetation for food, muskrat dig mud and vegetation from areas about their houses to obtain construction materials. This process also creates open pools that serve as use areas by various wetland birds. Muskrat houses often serve as nesting substrates for several bird species (e.g. Pied-billed Grebe, American Coot, Mallard, Black Tern). Platforms of vegetation cut by muskrats also are used by several of these bird species as nesting material or as substrates for nests.

On 14 November 1980, 310 muskrat houses were counted on Survey Areas 1, 2, 4 and 5 during our bird inventories. The largest number of houses occurred on Survey Area 2 (167), with the others in descending order of abundance being Area 4 (62), Area 1 (59), and Area 5 (2). The abundance of muskrat on Survey Areas 1, 2 and 4 is further evidence of the high productivity of these areas and their generally high quality as wildlife habitat. A suitable balance between muskrats and vegetation should be maintained in a marsh. Trapping activities within calculated and controlled limits can be used to keep muskrat numbers at a level where they do not overgraze a marsh. Trapping activities also provide recreation and financial gain for those involved. During fall 1979 and 1980, trappers worked the wetlands on the Pheasant Valley Hunting Club. Several species of mammalian predators (e.g. mink) occur on the Project Area and they also contribute to stabilization of the muskrat population.

Beaver constructed a lodge and dam at the northeast corner of Survey Area 5 in 1979. A cut was made in the dike and the beaver concentrate their foraging effort along the canals and on Survey Areas 1 and 4. Cottonwoods along the dike and numerous aspen on an island have been cut in Survey Area 1. On 14 November 1980, a large supply of winter browse had been stored by beaver in the canal near their lodge. Branches protruded above the surface at that time and this cache was photographed. In 1979, beaver stored food in the pond at the northeast corner of Survey Area 1. A beaver was shot by hunters during fall 1979, but an active family persisted throughout 1980.

The diversity of amphibians, reptiles and mammals seems to represent typical wetland diversity suggesting that habitat quality is suitable for the needs of an array of vertebrate species. Most of the species included in Tables 5-1 and 5-3 were observed on several occasions or sign (tracks and scat) were noted frequently.

Table 5-1. Amphibians and reptiles observed on the Project Area.

AMPHIBIANS	REPTILES
American Toad *Bufo americanus*	Snapping Turtle *Chelydra serpertina*
Bull Frog *Rana catesbeiana*	Blanding's Turtle *Emys blandingii*
Green Frog *Rana clamitans*	Painted Turtle *Chrystemys picta*
Leopard Frog *Rana pipiens*	Soft-shelled Turtle *Trionyx spinifer*
Tiger Salamander *Ambystoma tigrina*	Garter Snake *Thamnophis sirtalis*

Table 5-2. Endangered and threatened mammals, reptiles and amphibians on the Wisconsin list.

ENDANGERED	THREATENED
Mammals	
Pine Marten *Martes americana*	None
Canada Lynx *Lynx canadensis*	
Timber Wolf *Canis lupus* (also U.S. Endangered)	
Reptiles	
Wood Turtle *Clemmys insculpta*	Glass Lizard *Ophisaurus attenuatus*
Ornate Box Turtle *Terrapene ornata*	Blanding's Turtle *Emudoidea blandingii*
Queen Snake *Regina septevittata*	
Western Ribbon Snake *Thamnophis proximus*	
Northern Ribbon Snake *Thamnophis sauritus*	
Massassauga *Sistrurus catenatus*	
Amphibians	
None	Spotted Salamander *Ambystoma maculatum*
	Tremblay's Salamander *Ambystoma tremblayi*
	Burns' Leopard Frog *Rana pipiens burnsii*
	Pickerel Frog *Rana palustris*

Table 5-3. Mammals observed on the Project Area.

Red Bat
Lasiurus borealis

Raccoon
Procyon lotor

Long-tailed Weasel
Mustela frenata

Mink
Mustela vison

Red Fox
Vulpes vulpes

Woodchuck
Marmota monax

Eastern Chipmunk
Tamias striatus

Gray Squirrel
Sciurus carolinensis

Peromyscus sp.

Meadow Vole
Microtus pennsylvanicus

Muskrat
Ondatra zibethicus

Beaver
Castor canadensis

White-tailed Deer
Odocoileus virginiana

PART 6: SURVEY OF THE UPPER DES PLAINES RIVER FLOODPLAIN AND WETLAND FLORA AND VEGETATION

Paul D. Sørensen, Ph.D.

INTRODUCTION

The purpose of this study is to survey the flora and vegetation of the wetlands and adjacent uplands along a portion of the Des Plaines River in Kenosha County, Wisconsin, and to determine the value of these lands as habitat for plants and animals.

METHODS

Field Surveys of the Flora and Vegetation

Seventeen days were spent in the Project Area conducting plant surveys and related activities (Table 6-1). The area was traversed on foot, on horseback, in a four-wheel-drive vehicle, and by canoe. As the principal botanical investigator, I was present on all these dates and was accompanied by a field assistant during 11 of them.

The fundamental approach to the plant study was floristic; that is, an effort was made to observe and record every vascular plant species growing without cultivation in the entire Project Area. Additionally, the kinds of plant communities were identified and records were kept of the principal plant species characterizing each. While visiting the sites, lists were made of all the plant species that could be identified positively in the field. Species that could not be identified on sight were collected and preserved by conventional means for identification in the laboratory. This procedure also was followed when the plant in question belonged to groups in which the individual taxa could be determined only by small, detailed and technical characters that meant field identification might be open to question. Many of the sedges (Cyperaceae) fall into this latter category. All specimens resulting from these collections are on deposit in the Herbarium of Northern Illinois University, DeKalb, Illinois. Duplicates, when available, eventually will be deposited in the herbarium of Morton Arboretum.

While several standard manuals that cover the flora of this region were used to identify unknown plants, in all cases the nomenclature given in this report follows that adopted by Swink and Wilhelm (Ref. 1) who, in turn, base their nomenclature on that of Fernald (Ref. 2).

Field notes, together with records of specimen identification, were used to prepare a written description of each plant community recognized for the Project Area, and a total list of all species recorded. Personal observations along with species occurrence data were used to evaluate habitat quality insofar as can be judged from the flora and vegetation.

RESULTS

Synopsis of Plant Communities

Oosting (Ref. 3) defines a plant community as "an aggregation of living plant species that occur together." This definition was applied to the Project Area; particular aggregations of plants that occurred together are referred to as community types. The following community types were identified within the Project Area:

A. Aquatic and Semi-Aquatic Communities
   1. Submerged or floating plants of slow moving or standing waters.
   2. Emerged plants of littoral zones and marshes.
   3. Bulrush beds.
   4. Open, undrained depressions, seasonally inundated.
   5. Shaded, undrained depressions, seasonally inundated.
   6. Meadows around ponds and depressions.
   7. River terrace meadows.
   8. Margins of streams, canals, and sloughs (muddy margins).
   9. Riparian thickets.
   10. Alluvial woods along streams and river terraces.

B. Upland Communities, Open Sunny Areas
   11. Old fields and roadsides.
   12. Degraded remnants of mesic prairies.
   13. Margins of upland woods and seral woodlands.

C. Upland Communities, Shaded Areas
   14. Deciduous forest.

D. Weed Habitats.
   15. Disturbed areas along walks, paths, roadways, edges

of cultivated fields, corrals, and around foundations of barns and other structures

Description of Plant Communities

Fifteen plant communities were identified and described for the Project Area. Community status was assigned on the basis of the following characteristics: 1) physical features; 2) principal plant species; and 3) the most prevalent associated species. This report provides a list of locations where examples of each community type were found within the Project Area; an estimate of the total amount of each community type; and, a list of typical species that make up each community.

The lists of species accompanying each community description represent typical species only, and are not exhaustive accounts. A complete list of plant species found in the Project Area is provided in Table 6-2. The abbreviated lists are intended to convey an impression of each community based upon plant species having well-known habitat preferences. Plant species with very wide ecological amplitude may occur in an assortment of habitats, consequently such species are excluded from the abbreviated lists.

A. Aquatic and Semi-Aquatic Communities

Community Type 1. Submerged or floating plants of slow-moving or standing waters.--All areas of open water that support some vegetation are included: the Des Plaines River and its tributaries; slow-moving water in canals; and, standing water of ponds, marshes, and pond-marshes. This community type corresponds to the "O" for open water and "D" for duckweed designations on the vegetation overlay, Plate 17, in the work by Shines (Ref. 1).

During periods of high water caused by run-off, the Des Plaines River might be described as a fast-flowing stream but, during part of the growing season, the river level subsides and the stream slows down enough to allow a meager flora to become established. Just two plant species grow in the river bed proper: *Heteranthera dubia* (Water Stargrass) and *Nuphar advena* (Spatterdock). The former is found at the extreme southern end of the Project Area, rooted on the bottom, where the river widens and becomes quite shallow and slow-moving. The latter forms patches with their familiar broad floating leaves in the river bed adjacent to the quarry woods in the southeast quarter of Section 19, just northwest of Survey Area 4 (Fig. 6-1). These two species hardly constitute a stream bed community, especially when one considers how far apart they occur. They are mentioned here primarily for the sake of completeness. Throughout the 1980 growing season, water level in the river never receded to a point that the bottom was clearly visible. Possibly a few additional submerged species occur in the river bed.

Compared with the sparce flora of the Des Plaines River, the submerged flora of open waters elsewhere is rather rich. Owing to the nature of reproduction and other characteristics of certain floating and submerged plants, it is difficult to assign dominance to one or two species. For example, in the early part of the growing season a tiny floating plant called Duckweed (*Lemna minor*) may be represented by just a few individuals. As the season advances and waters warm, Duckweed undergoes massive vegetative reproduction to the extent that this single species, or a combination of this species and one or more of its close relatives (*Spirodela polyrhiza*, Great Duckweed and *Wolffia columbiana*, Water Meal) may cover entire bodies of water. As autumn approaches and as various animals continue to forage on these plants, they decline remarkably in number.

The floristic composition of open waters is quite similar from place to place. The reason for this is again a function of the kinds of reproduction that take place. The duckweeds mentioned above can float freely from place to place within contiguous waters, as in the canals and marshes of Survey Areas 1, 4 and 5 (Fig. 6-1). Likewise, even plants anchored on the bottom disperse when pieces break off, float to a new location, take hold, and grow. Waterfowl and mammals serve as dispersal agents when they carry bits of these plants across non-aquatic areas and introduce them into other bodies of water.

The consistent repetition of the floristic composition unifies the several bodies of open water into one community type. There are essential differences, however, in physiognomy that characterize each of the facies of this community type within the Project Area

Facies 1. *Stream beds*.--The stream bed proper of the Des Plaines River and its tributaries represents the most aberrant expression of the open water community type owing to its depauperate flora. Only in the extreme southern portion of the river does species diversity increase, but in this instance the diversity is derived from associated bulrush beds designated here as Community Type 3.

Facies 2. *Slow-moving waters of canals*.--Since all the canals have been dug and do not represent natural waterways, they lack gradually sloping sides or margins. Thus the transition from upland habitats (along dikes) to open water takes place over a very short distance. In such circumstances, emergent vegetation or a littoral zone (Community Type 2) cannot develop. A further hindrance to development of a littoral zone is the composition of the bottom beneath the open water. Bottom rooted plants that remain submerged (except for a brief period when their flowering parts protrude from the water) are not encumbered in their development nor are the floating plants. Canals occur within or along Survey Areas 1, 2, 4 and 5 (Fig. 6-1).

Facies 3. Ponds and pond-marshes.--The pond-marsh habitat is characterized by open water lacking any interspersion of emergent vegetation. The absence of emergent vegetation is a function of water depth in a transect perpendicular to the shore. The name "pond-marsh" is applied to indicate that the pond, being a natural body of water, has gently sloping sides that can support a distinct band of emergent vegetation making up a marsh-like transition area known as the littoral zone. Some of the floating and submerged plants of the open water community may be present among the emergent sedges and bulrushes of the littoral zone but the reverse does not occur. The best example of pond-marsh habitat occurs in the eastern sector of Survey Area 2 (Fig. 6-1). Others are found more or less in the centers of Survey Areas 3 and 4. What may have been an old meander of the Des Plaines River that now has acquired the general characteristics of a pond-marsh is situated directly west of the quarry woods in Section 19.

Facies 4. Open water and marshes.--The open water of marshes is distinct from open water of ponds and pond-marshes in that the area of open water is interspersed with clumps of emergent vegetation and sometimes also exposed mud or even small islands of upland habitat. Marshes form over natural terrain with typically undulating swell and swail topography resulting in varied water depths that produce the patchy or mosaic-like nature of such habitats. As with the pond-marsh, floating and submerged plants can appear among the stalks of the sedge and cattail clumps. One of the best and most extensive examples of this habitat type in the Project Area is found in Survey Area 1 (Fig. 6-1). This tract also yielded the largest number of plant species. Open water marshes also can be found in Survey Areas 2, 3, 4 and 5 (Fig. 6-1); in backwaters of the river north of County HIghway ML; and east of the Des Plaines River in Section 32.

Typical floating and submerged plants colonizing open waters throughout the Project Area include the following:

Lemna minor
Lemna trisulca
Ceratophyllum demersum
Myriophyllum exalbescens
Najas flexilis
Nuphar advena
Nymphaea tuberosa
Potamogeton foliosus
Potamogeton pectinatus
Ranunculus longirostris
Spirodela polyrhiza
Utricularia vulgaris
Wolffia columbiana

Community Type 2. Emergent plants of littoral zones and marshes.--In shallow waters and where the transition from open water to upland areas is very gradual, there occur patches and zones of vegetation characterized by upright growing plants that elevate both their vegetative and reproductive parts above the water. These are the emergent plants that comprise the littoral community (designation in part or all of Se-Sedge, Sp-Cord Grass, RC-Rush & Cattail of Shines, Ref. 4). Owing to its frequent occurrence as a band around bodies of water, it is most convenient to visualize this community type as a zone. Littoral zone is the most conspicuous wetland vegetation that develops where shallow standing water remains the whole year. The principal species making up the community typically have tall, coarse stalks 1-2.4 meters above the water and grow from sturdy, creeping rhizomes. The rhizomatous habit allows a species, once established, to form large clones that can be so dense as to exclude entirely other tall-growing species of similar habit. The arrangement that results from these characteristics of littoral species is a patchwork of different clones in which a clump of cattails may give way to a stand of Great Bulrush (Scirpus acutus) that in turn a bit farther on is replaced by Sweet Flag (Acorus calamus) or some other coarse-growing species. In such circumstances, dominance of a single species shifts from one to the next as one proceeds along a transect. Most often, sufficient searching in any particular marsh will produce representatives of the preceding species plus all of the following that share these growh characteristics:

Phragmites communis
Scirpus fluviatilis
Scirpus validus
Sparganium eurycarpum
Typha angustifolia
Typha latifolia

As mentioned under Community Type 1, the floating plants of open water habitats can be found among the tall sedges and cattails of the littoral zone. When the floating plants disperse among the sedge stalks, they are protected from being blown out into open water again. Here they reproduce vegetatively in profusion and form solid mats that have the effect of shading the underwater plants as the latter die. Thus, in the later parts of the growing season, the littoral zone community includes floating plants but the underwater plants may disappear or decline. Some plants that are part of the littoral community do not actually take root in the bottom but have their roots suspended in the water. Lacking a firm anchorage, these plants are unable to elevate their stems above the water except where they are supported by the sturdier sedges and cattails. An example is the annual Stiff Bedstraw (Galium tinctorium). Bottom-rooted, stool-forming species such as one of the sedges (Carex hystricina) form yet another kind of plant characterizing littoral zone vegetation.

Plants of the littoral zone are not dependent upon being constantly in standing water. Indeed, some of the species with sturdy rhizomes occasionally can be found creeping out of the wetlands and persisting on convex topography. Moreover, most of the littoral zone species also can be found in meadows

(Community Type 6) where they do not attain dominance. Their occurrence in meadows may be interpreted in this way: the lowlands along the Des Plaines River, even those that we know to be only seasonally inundated (Community Types 4 & 5), are flooded often enough and for long enough periods for occasional littoral zone species to take hold. When the waters recede the sturdy rhizomes of these plants aid them in persisting. The reverse movement, from meadow to littoral zones, cannot take place because the meadow species are intolerant of having their roots submerged constantly. Thus littoral zone species are components of the flora of meadows and occasionally even more upland communities, but upland and meadow plants are not part of the littoral zone flora.

Excellent examples of littoral zone vegetation can be found in several places in the Project Area. Most noteable, owing to rather complete representation of species, are those that make up large portions of Survey Areas 1 and 2 (Fig. 6-1), and to a lesser extent in Survey Area 3. Small patches occur among the stands of deciduous forest on the Pheasant Valley Hunting Club property and directly south of the club in Section 32. Northwest of the quarry in the west center of Section 20 is another small example.

Littoral zone species in addition to those mentioned or listed previously are:

Acorus calamus
Alisma subcordatum
Alisma triviale
Equisetum fluviatile
Cicuta maculata
Ludwigia palustris
Polygonum coccineum
Polygonum hydropiperoides
Proserpinaca palustris
Ranunculus pensylvanicus
Salix interior
Scirpus cyperinus
Scutellaria lateriflora
Sium suave

Community Type 3. *Bulrush beds.*--Extensive areas along both sides of the Des Plaines River and around depressions throughout the Project Area are sometimes given over to stands of the River Bulrush (*Scirpus fluviatile*) in which very few other species grow. These stands represent essentially large areas of littoral zone vegetation and one might feasibly include them as another facies of that community type; however, I have chosen to keep them separate and call them bulrush beds. Two factors influenced this decision: 1) the community lacks the floristic diversity of typical littoral zones; and 2) unlike littoral zone vegetation, bulrush beds seem to occur where water levels fluctuate greatly. Indeed, it appears that they can withstand long periods without being submerged. It is beyond the scope of this study to explain fully the factors that contribute to the development of bulrush beds in favor of typical littoral zone vegetation. No doubt the factors involve a combination of the aggressive nature of the principal species as well as seasonal changes in the physical characteristics of the habitat.

The River Bulrush is a coarse perennial with stiff, triangular culms. It reproduces principally by vegetative means and where it has once taken hold it need not rely upon seedling establishment for spreading outward. The plants are very durable and can recover quickly from serious kinds of disturbances, such as all terrain vehicle (ATV) traffic.

Curtis (Ref. 5) barely mentions River Bulrush as a major component of aquatic vegetation in Wisconsin. Nowhere does he bring out the fact, as do Swink and Wilhelm (Ref. 3), that the species can predominate, to the exclusion of other species, over large areas of wetland. Possibly its importance and prevalence as a wetland species is something of a local phenomenon and extensive beds of River Bulrush may not occur elsewhere in the state. During a floristic study covering 1600 square miles (2560 sq. km.) of Central Wisconsin, I (Ref. 6) did not record the species. It is likely that the recognition of bulrush beds as a distinct community type, or as a distinct facies of littoral communities, is reported here for the first time.

Good examples of bulrush beds occur along both sides of the Des Plaines River at the south end of the Project Area (Section 32). In Section 19, the zone of emergent vegetation surrounding a quiet backwater of the river is mostly bulrush bed. Perhaps the largest unbroken expanses of River Bulrush is in Survey Area 3 (Fig. 6-1).

One can traverse several hundred feet of bulrush bed and not encounter another plant species; nevertheless, with diligent searching a few do appear. The list that follows contains the entire complement of species in the bulrush bed in Survey Area 3:

Polygonum hydropiperoides
Lemna trisulca
Bidens vulgata
Scirpus acutus
Scirpus validus

Community Type 4. Open undrained depressions, seasonally inundated.--The essential character of these communities is that they develop in places that accumulate water early in the growing period thereby preventing vegetation from taking hold until the water recedes. Seedlings of fall flowering annuals such as Spanish Needles (Bidens spp.) and Barnyard Grass (Echinochloa crus-galli) begin to appear on the exposed mudflats by the middle of the growing season. These species and others of the community can tolerate periodic flooding throughout their life cycle. Some perennials, e.g., Marsh Milkweed (Asclepias incarnata), also may become established as the season progresses. This latter species also is indicative of seasonal or temporary drying as it is not a component of the flora found in permanently flooded areas.

Most examples of Community Type 4 were found in parts of cultivated fields and as patches in meadows. The fields may be cultivated in years when they dry sufficiently early to be planted to crops. Open, undrained depressions appear in several places on the Hunting Club property, in Section 32 on both sides of the Des Plaines River, west of the river in the northeast corner of Section 9, and in small patches around the perimeter of Survey Areas 2 and 4 (Fig. 6-1). When flooded in the fall, these areas provide good foraging habitat for waterfowl.

Typical plant species of Community Type 4 are:

Asclepias incarnata
Aster prealtus
Bidens cernua
Calamagrostis canadensis
Cirsium arvense
Echinochloa crus-galli
Erigeron strigosus
Mimulus ringens
Panicum dichotomiflorum
Phalaris arundinacea
Bidens frondosa
Bidens vulgata
Boltonia latisquama
Physostegia parviflora
Polygonum pensylvanicum
Rumex verticillatus
Salix bebbiana
Salix interior
Salix rigida
Sphenopholis intermedia
Vernonia fasciculata

Community Type 5. *Shaded undrained depressions, seasonally inundated.*--As with Community Type 4, this one also develops upon silty and muddy soils exposed after spring flood waters have drained away or evaporated. The two communities (4 and 5) differ mainly in floristic composition. Inevitably, some species will be found in both types of habitats but other species are completely restricted to shaded versus open depressions. The shaded character of this community type results from its occurrence in association with surrounding forest. The vegetation of the depression area is wholly herbaceous, but along the margins there usually appear some invasive shrubs such as willows (*Salix* spp.) and dogwoods (*Cornus* spp.) or trees (e.g. *Populus* spp.).

The best example of Community Type 5 is a crescent-shaped depression that runs through the oak forest in Sections 19 and 20, just east of a big bend in the Des Plaines River. This depression looks as though it might be an old meander of the river that is now cut off. It may have been an ox-bow lake at one time in the past. Elsewhere shaded depressions occur in small patches in the wooded areas of the Hunting Club property and on the Girl Scout property.

Typical species in this community are:

Boehmeria cylindrica
Elymus virginicus
Equisetum arvense
Hackelia virginiana
Impatiens pallida
Iris virginica
Leersia oryzoides
Lysimachia thyrsiflora

Community Type 6. *Meadows around ponds and depressions*.--Wherever the terrain surrounding depressions is generally flat and poorly drained, a vegetation develops that is characteristically rich in grasses, sedges, and forbs. In the more upland, and hence better drained and drier portions of these areas, the vegetation can take on the appearance of a prairie; in the lower and more poorly drained areas, the appearance is similar to littoral zone vegetation. Here and there woody plant clumps and thickets dot the meadow.

A majority of meadow species are perennial and many have tough rhizomes. As with littoral vegetation, meadows acquire a patchy look with a single species forming a clone that adjoins the clone of a second, or even a third species. Co-mingling with the clonal species are those plants that do not form patches but instead produce stools, clumps, or grow from a single stalk. Under these circumstances one cannot assign dominance to any plant species over sizeable portions of the community. Some of the more prevalent species, however, are Blue Joint (*Calamagrostis canadensis*), Tall Goldenrod (*Solidago altissima* and *S. gigantea*), a stool-forming sedge, *Carex haydenii*, Slough Grass (*Spartina pectinata*), and Reed Canary Grass (*Phalaris arundinacea*), the single most prevalent terrestrial plant species found in the entire Project Area.

Scattered throughout the Project Area there are patches of dry upland habitats containing strips, zones, or patches of meadow vegetation. Excellent examples of such sites occur in Survey Areas 2 and 5 (Fig. 6-1). In both areas, the meadow vegetation grades into forest on the dry side and into wetland on the moist side. Other extensive areas of meadow occur in the northwest portion of Section 20 and in the adjacent southwest part of Section 17. Irregular strips of meadow appear here and there along the entire length of the Des Plaines River, wherever the river terraces are sufficiently high to avoid prolonged flooding. On the aerial overlay prepared by Shines (Ref. 4) the designation LG, Lowland Grasses, corresponds most closely to my classification of meadow.

Meadow vegetation surpasses all other wetlands in species diversity. The following are typical species:

Anemone canadensis
Apocynum sibiricum
Asclepias incarnata
Aster novae-angliae
Aster simplex
Bidens connata
Boltonia latisquama
Campanula aparinoides
Carex lanuginosa
Cicuta maculata
Cornus stolonifera

Galium obtusum
Galium tinctorium
Geum laciniatum
Impatiens capensis
Iris virginica
Lathyrus palustris
Leersia oryzoides
Lycopus americanus
Lysimachia quadriflora
Lysimachia thrysiflora
Mentha arvensis

Cyperus strigosus
Eleocharis palustris
Epilobium coloratum
Epilobium glandulosum
Polygonum coccineum
Polygonum hydropiperoides
Polygonum lapathifolium
Ranunculus pensylvanicus
Ribes americanum
Rorripa islandica
Rosa blanda
Salix bebbiana
Salix gracilis
Salix interior
Salix rigida
Scirpus acutus
Mimulus ringens
Physocarpus opulifolius
Poa palustris
Polygonum amphibium
Scirpus validus
Scutellaria epilobiifolia
Scutellaria lateriflora
Sium suave
Solanum dulcamara
Sphenopholis intermeadia
Spiraea alba
Stachys tenuifolia
Thalictrum dasycarpum
Urtica procera
Verbena hastata
Vernonia fasciculata

Community Type 7. *River terrace meadows*.--There are similarities between the meadows of river terraces and the meadows described above as Community Type 6. I described the river terrace meadows as a distinct community type because of its rather consistent occurrence along the Des Plaines River and because its plant species diversity is consistently much lower than that associated with meadow vegetation.

The dominant plant species and often the only one present is Reed Canary Grass (*Phalaris arundinacea*). Establishment of this coarse wetlands perennial grass eventually reduces species diversity wherever it occurs. Examples of river terrace meadows stretch more or less the entire length of the Des Plaines River through the Project Area. Away from the river bed Reed Canary Grass meadows are found in numerous places. Large expanses occur in the eastern part of Section 30 and the western part of Section 29. This vegetation type probably is less extensive than indicated by Shines (Ref. 4). Some of what she calls R (for Reed Canary Grass) no doubt represents Community Type 6.

A slightly different facies of river terrace meadows has been created on convex topography by dredging out canals to form the dikes in Survey Areas 1, 4 and 5 and at the north end of Survey Area 2 (Fig. 6-1). Plants growing on the dikes are not included in the list of species for this community type even though Reed Canary Grass is the dominant species. This procedure was adopted because the scooping up of adjacent meadow substrate to build the dikes introduces rhizomes of meadow species, some of which manage to survive. Today, these dikes support a mixture of species normally not found together, including recent terrestrial colonizers, such as Box-elder (*Acer negundo*), along with persistent meadow species such as Blue Flag (*Iris virginica*) and Cattail (*Typha latifolia*), plus many others.

The species listed below as typical of river terrace meadows are never very abundant but occur in small patches representing perhaps clumps that persist after the site has been taken over by Reed Canary Grass rather than recent colonizers.

Calamagrostis canadensis
Crataegus coccinea
Erechtites hieracifolia
Phragmites communis
Polygonum coccineum
Pyrus ioense
Rosa blanda
Salix bebbiana
Salix gracilis
Salix interior
Spartina pectinata
Urtica procera

Community Type 8. *Muddy margins of streams, canals and sloughs*.--Although not very large in the aggregate, muddy margins support a distinctive flora. The habitat is just at the water's edge where more upland communities give way to aquatic communities. Here, where a harrow band of mud and/or organic ooze is open to colonization, plants occur that are not seen in other habitats of the Project Area (e.g. Needle-grass, *Eleocharis acicularis*). The plants of this community take advantage of the increased amount of sunlight that reaches them from the open water side. They are prevented from spreading into upland areas by the taller-growing reeds and grasses that would shade them out and their intolerance of standing water prevents them from becoming part of the littoral zone flora. Thus, the best developed examples of muddy margin communities are found where the terrain slopes steeply into open water areas leaving little space for the growth of coarse species of littoral zone vegetation. Sites with these kinds of conditions are found in Survey Area 2 of the Girl Scout property, at the north end of Survey Area 2 along the canal, and at similar sites along canals within other survey areas (Fig. 6-1).

The following list of muddy margin plants is compiled from numerous small increments of this habitat type throughout the Project Area:

Acnida altissima
Alisma subcordatum
Asclepias incarnata
Cardamine pensylvanica
Cicuta maculata
Eleocharis acicularis
Eleocharis palustris
Erigeron strigosus
Geum laciniatum
Galium aparine
Impatiens capensis
Iris virginica
Lobelia spicata
Lycopus americanus
Mentha arvensis
Parietaria pensylvanica
Potentilla norvegica
Ranunculus abortivus
Rumex verticillatus
Scutellaria lateriflora
Sonchus uliginosus
Verbena hastata

Community Type 9. *Riparian thickets*.--Riparian thickets are patches of woody vegetation made up of shrubs, woody vines, and young trees that develop along the floodplain and terraces of the Des Plaines River and its tributaries. Sometimes these thickets are very difficult to pass through because of the density of the canes. Unless burned or destroyed by floods the tendency is for them to develop slowly into alluvial forest. This process is hastened where shrubs, such as willows, and trees typical of alluvial forest (Community Type 10) happen to colonize a site more or less at the same time. If willows get a head start and manage to produce a fairly dense shade within the stand, alluvial forest species cannot flourish. A fine example of this latter kind of thicket composed of three species of willow (*Salix interior*, *S. petiolaris*, and *S. rigida*) has grown up in Section 32 east of the river at the north end of the agricultural fields. Elsewhere good examples are found close to the river in Section 29, on the Hunting Club property. The designation by Shine (Ref. 4) for willow vegetation is "W" and her perception of that community type in the overlay of the aerial photo with a few exceptions corresponds to the riparian thickets described here.

Of the 27 species listed below as typical of riparian thickets in the Project Area, only five are herbaceous. This disproportionately low representation of herbaceous plants exemplifies the predominance of woody plants in this community.

Acer negundo
Acer saccharinum
Ambrosia trifida
Cornus racemosa
Crataegus crus-galli
Cuscuta spp.
Laportea canadensis
Morus alba
Parthenocissus vitacea
Poa palustris
Populus deltoides
Prunus americana
Prunus serotina
Pyrus ioense
Pyrus malus
Rhamnus cathartica
Rosa multiflora
Rudbeckia laciniata
Salix alba
Salix amygdaloides
Salix bebbiana
Salix fragilis
Salix interior
Salix nigra
Salix rigida
Sambucus canadensis
Vitis riparia

Community Type 10. *Alluvial woods along streams and river terraces*.--Alluvial woods are characterized by mature trees growing on fine-textured, silty soils that remain at or beyond field capacity (the amount of water left after gravitational drainage has taken place) through the entire growing season. Alluvial areas typically undergo seasonal inundation as well as periodic inundation during times of high rainfall. Spring and often fall flooding bring new layers of silts to the sites that later become available for colonization by herbaceous annuals such as Wood Nettle (*Laportea canadensis*), Clear Weed (*Pilea pumila*), or Nimble-will (*Muhlenbergia schreberi*). Owing to the particular seed source at hand, the herbaceous understory can vary considerably from place to place. For example, in one portion of an alluvial forest the Wood Nettle may form a monotypic stand over a wide area, elsewhere another of those mentioned above may predominate. The tree species that comprise the canopy include Cottonwood (*Populus deltoides*), Common Elm (*Ulmus americana*), Silver Maple (*Acer saccharinum*), and Black Willow (*Salix nigra*).

Most of the alluvial woodlands in the Project Area consist of rather narrow stands developed on strips of river terrace. The largest expanse occurs where the upland forest on the Hunting Club approaches the river between Survey Areas 3 and 5 (Fig. 6-1). Similar habitat is found between the river and upland forest north of Survey Area 4. Alluvial woodlands recognized in this report correspond to the designation "C" for Cottonwood as given by Shines (Ref. 4).

Typical plant species of alluvial woodlands are:

Acer negundo
Acer saccharinum
Allium canadense
Allium tricoccum
Ambrosia trifida
Boehmeria cylindrica
Crataegus spp.
Elymus virginicus
Equisetum arvense
Erythronium albidum
Hydrophyllum virginianum
Isopyrum biternatum
Lonicera tartarica
Lysimachia nummularia
Lysimachia thrysiflora
Osmorhiza claytoni
Populus deltoides
Populus grandidentata
Populus tremuloides
Potentilla norvegica
Potentilla simplex
Pyrus ioense
Quercus ellipsoidalis
Quercus macrocarpa
Ranunculus abortivus
Ranunculus septentrionalis
Rhamnus cathartica
Rubus occidentalis
Rudbeckia laciniata
Salix alba
Salix nigra
Sanicula gregaria
Trillium recurvatum
Ulmus americana
Viburnum lentago

B. Upland Communities, Open Sunny Areas

Community Type 11. *Old fields and roadsides*.--These are weedy habitats. An abandoned field remains "weedy" for a number of years following its withdrawal from cultivation. The plant species that flourish here are called weeds because of their aggressive nature. They move rapidly into an available habitat but may not persist there for long. Whereas many of the early colonizers are annuals, some of the aggressive species are perennial and, consequently, often remain part of the "old field" flora long after the annual weedy species have declined.

Old fields occupy areas of intermediate elevation with respect to the Des Plaines River bottomland. They are on terrain high enough to avoid excessive flooding except during the worst of times but low enough to be covered by spring flood waters that contribute a periodic deposition of silts. The disturbance caused by flooding and silt deposition has the effect of encouraging reproduction of weedy species that seem suited to a perturbed environment. Among these are several perennial Eurasian grasses, long ago introduced as pasture grasses but now found widespread in an assortment of habitats. They are the sod forming species of Hungarian Brome (*Bromus inermis*), Timothy (*Phleum pratense*), and Kentucky Blue Grass (*Poa pratensis*). Old fields having remained unplowed for several years support a vegetation in which these three grasses have a major or dominant role. Once established they form a tough sod that resists the successful invasion of woody plants. Periodic mowing for hay, considered high quality from such fields, undoubtedly also aids in keeping out shrubs and trees.

Since various kinds of agriculture and animal husbandry have probably been the past history of most of the upland parts of the Project Area, remnants of old fields and pastures are found frequently. Several tracts dot the Hunting Club property as well as the area south of it. A large amount of old field is located on the west side of the river northeast of the Girl Scout property, also, northwest of the quarry across a channelized stream. Shine (Ref. 4) designates a community as "UG" for upland grasses that corresponds to my category of old fields.

Typical floristic elements of old fields reflect a mixture of annuals and perennials as follows:

Achillea millefolium
Agropyron repens
Agrostis alba
Asclepias syriaca
Ambrosia artemisiifolia
Barbarea vulgaris
Brassica nigra
Bromus inermis
Capsella bursa-pastoris
Carduus nutans
Geum laciniatum
Hordeum jubatum
Juncus tenuis
Lactuca scariola
Lepidium campestre
Lepidium virginicum
Lychnis alba
Medicago lupulina
Medicago sativa
Melilotus alba
Oenothera biennis
Oxalis europea
Carex sparganioides
Chenopodium album
Cichorium intybus
Cirsium arvense
Cirsium vulgare
Dactylis glomerata
Daucus carota
Dracocephalum parviflorum
Erigeron canadensis
Erigeron strigosus
Poa pratensis
Polygonum sagittatum
Potentilla norvegica
Potentilla recta
Rosa carolina
Rumex crispus
Senecio plattensis
Silene cucubalus
Stellaria media
Solanum dulcamara
Taraxacum officinalis
Thlaspi arvense

Oxalis stricta
Phleum pratense
Plantago lanceolata
Plantago major
Plantago rugellii
Tragopogon major
Trifolium hybridum
Trifolium pratense
Trifolium repens
Veronica peregrina

Community Type 12. *Degraded remnants of mesic prairie*.--Prairie-dock (*Silphium terebinthinaceum*), an herbaceous perennial with huge fan-shaped basal leaves, is the most conspicuous species signalling the location of this habitat. This species, along with several of its associates, is completely intolerant of plowing and thus may be used as an indicator of where prairie vegetation was present in the past. Today most of these prairie patches have been destroyed by conversion to cultivated fields or they have been grazed to such an extent that non-prairie species have invaded the community, gradually changing it to something quite different, usually seral woodland (Community Type 13).

Within the Project Area proper, I recorded a small patch of remnant prairie located in Section 29 between stands of Bur Oak woods on the Hunting Club. Another occurs along the Chicago, Milwaukee, St. Paul, and Pacific Railroad line in Section 32. Shine (Ref. 4) was unable to discriminate this community type. The two tracts mentioned here are designated by her as "F" for forest (owing to the proximity of the first to a Bur Oak stand), "LG" for lowland grasses, and "R" for Reed Canary Grass. Typical mesic prairie species that persist even in degraded remnants along with some recent invaders found in the two sites are:

Achillea millefolium
Allium cernuum
Amorpha canescens
Andropogon gerardi
Anemone canadensis
Aster ericoides
Aster laevis
Aster novae-angliae
Aster pilosus
Coronilla varia
Euphorbia corollata
Gentiana andrewsii
Helianthus laetiflorus
Heliopsis helianthoides
Juncus torreyi
Lathyrus palustris
Linaria vulgaris
Oxalis europea
Panicum virgatum
Pycnanthemum virginianum
Ratibida pinnata
Rosa arkansana
Rosa carolina
Rubus allegheniensis
Rudbeckia hirta
Scirpus lineatus
Scrophularia lanceolata
Silphium integrifolium
Silphium terebinthinaceum
Smilacina racemosa
Solidago gigantea
Solidago graminifolia
Solidago rigida
Spiranthes cernua
Sporobolus vaginiflorus
Veronicastrum virginicum

Community Type 13. *Margins of upland woods, fencerows, and seral woodlands*.--Habitats of this sort often combine elements of both forest and field communities. Under natural conditions these are unstable areas that gradually change with the expansion and development of mature forest communities. In places where the adjacent fields are cultivated, however, as in the Project Area, the woodland margins remain more or less stationary. Seral upland woods are the kind that develop in previously grazed, timbered, or cultivated areas that are now abandoned. The assemblage of species making up the flora of these kinds of sites is remarkably similar. It includes herbaceous perennials of open habitats, such as Downy Aster (*Aster pilosus*) and Sunflower (*Helianthus strumosus*); scrubby trees of seral woodlands such as Cockspur Thorn (*Crataegus crus-galli*) and Box-elder (*Acer negundo*); and young saplings that are among the principal trees of mature upland woods, such as Shagbark Hickory (*Carya ovata*) and Black Oak (*Quercus velutina*).

Since much of the land in the Project Area was once cultivated or pastured but now abandoned, there are many acres of seral upland woods. Woodland edge or margin is also extensive owing to many discontinuities in forested land that may have resulted from activities such as building roads and clearing fields. The vegetation that develops along fences is a further expression of this same assemblage of species. Thus, in total when one adds the hundreds of meters of forest edge to those of the fencerows and then combines these with the acreage of seral woodlands, the aggregate comprises a considerable proportion of the Project Area. Shine (Ref. 4) does not distinguish between mature forest and seral woodland communities. In addition to the six species mentioned above, the following are also typical:

Achillea millefolium
Agropyron repens
Arctium minus
Crataegus coccinea
Crataegus margaretta
Elymus virginicus
Fraxinus pennsylvanicus
Galium aparine
Geum canadense
Helianthus grosseserratus
Monarda fistulosa
Morus alba
Physalis subglabrata
Poa compressa
Poa pratensis
Polygonatum cannaliculatum
Polygonum scandens
Potentilla norvegica
Potentilla recta
Prunus americana
Prunus serotina
Prunus virginiana
Pyrus ioense
Quercus alba
Quercus macrocarpa
Rhamnus cathartica
Rhus glabra
Rhus radicans
Rosa multiflora
Rubus allegheniensis
Rubus occidentalis
Sambucus canadensis
Setaria glauca
Solanum dulcamara
Solidago altissima
Sonchus uliginosus
Stachys tenuifolia
Ulmus americana
Ulmus rubra
Verbena urticifolia
Viburnum lentago

C. Upland Communities, Shaded Areas

Community Type 14. Deciduous forest.--Oak-hickory forest makes up the major amount of upland deciduous forest present in the Project Area. At one site the oak-hickory is replaced by a small stand of Sugar Maple (Acer saccharum) indicating that a Sugar Maple forest eventually may develop at the expense of oak-hickory. In other places there occur remnant stands of Bur Oak groves. I have grouped these three upland deciduous forest types under one category inasmuch as I did not observe clear differences among them in their floristic composition. The presence of the Bur Oak groves has an historical basis in connection with past prairie communities. Now, however, the understory of the Bur Oak stands is substantially like that of any other deciduous forest nearby. Indeed, the reproduction of tree species, as noted in the identity of the saplings, indicates that they will become typical oak-hickory forests.

None of the forest tracts cover wide unbroken areas. All of them occur either as islands in the floodplain where convex topography exists or they have been broken up by the construction of roads, ponds, fields, and the like. The largest expanse (before the construction of a road through it) is the forested tract lying west of the gravel quarry and northwest of Survey Area 4 (Fig. 6-1). Of all the natural habitats presently found in the Project Area, this one has the greatest number of native plant species, and it seems least perturbed by human activities (though recent road-building in one sector has left some extremely severe scars and disrupted habitat). This forest is mostly of the oak-hickory type, with White Oak (Quercus alba) and Shagbark Hickory (Carya ovata) clearly dominant. Slight topographic discontinuities, such as a small slope with an elevation change no greater than 2 meters, allow for a shift toward Sugar Maple. Basswood (Tilia americana) and Sugar Maple comprise the dominant species of the climatic climax forest for this region (Ref. 5). Vigorous reproduction of Basswood is evident throughout this tract indicating that the forest may be developing toward climax conditions.

Other extensive deciduous forest tracts in the Project Area are located on the Hunting Club property and across the Des Plaines River on the Girl Scout property, Sections 29 and 30, respectively. These parcels, while remaining reasonably good as woodland habitat, show signs of disturbance, as from past grazing. I expect, however, that none of the original woodland species have been extirpated from them. There are signs indicating that owners of the Girl Scout property have, in the past, attempted to convert wild forest areas into park-like settings by underplanting ornamental perennials and conifers among the woodland oaks and hickories. Grazing seems to have been the principal form of disturbance in the Hunting Club woods but, again, the woodland flora is still present, with only the relative numbers of individuals of the several species changed as a result of past use.

The designation "F" for Hardwood Forest by Shines (Ref. 4) corresponds to deciduous forest as described here.

Many of the species on the following list are confined to a woodland habitat and thus are restricted in their distribution within the Project Area to the patches of forest described above (or their equivalent):

Actea rubra
Agrimonia gryposepala
Agrimonia pubescens
Amphicarpa bracteata
Anemonella thalictroides
Aralia nudicaulis
Asclepias exaltata
Athyrium filix-femina
Bromus purgans
Campanula americana
Carex blanda
Carex cephalophora
Carex rosea
Carex tribuloides
Carya cordiformis
Caulophyllum thalictroides
Circea quadrisulcata
Cornus racemosa
Corylus americana
Crataegus spp.
Dentaria laciniata
Desmodium glutinosum
Dioscorea villosa
Dodecatheon meadia
Erythronium albidum
Fraxinus americana
Galium aparine
Galium concinnum
Geranium maculatum
Geum canadense
Hepatica acutiloba
Hydrophyllum virginianum
Hystrix patula
Isopyrum biternatum
Lonicera dioica
Lonicera tartarica
Menispermum canadense
Onoclea sensibilis
Osmorhiza claytoni
Osmorhiza longistylis
Parthenocissus quinquefolia
Physocarpus opulifolius
Podophyllum peltatum
Potentilla simplex
Prenanthes alba
Prunus serotina
Prunus virginiana
Quercus ellipsoidalis
Quercus macrocarpa
Quercus rubra
Quercus velutina
Ranunculus fascicularis
Ranunculus septentrionalis
Rhamnus cathartica
Rubus allegheniensis
Rubus occidentalis
Silene stellata
Smilax herbacea
Taenidia integerrima
Thalictrum dioicum
Trillium flexipes
Trillium recurvatum
Triosteum aurantiacum
Viburnum lentago
Viburnum rafinesquianum
Viola pensylvanica
Viola sororia
Vitis riparia

D. Weed Habitats

Community Type 15. *Disturbed areas along walks, paths, roadways, edges of cultivated fields, corrals, and around foundations of barns and other structures.*--Disturbed places that fit into this community type mostly occur in upland areas. While the present study is primarily directed at the wetlands of the

Project Area, it is worthwhile for the sake of completeness to report the composition of the upland weed flora.

In the list that follows there appear many species that have been introduced from abroad and represent familiar garden and sidewalk weeds known generally across the Upper Midwest. The name of the places where such communities occur describes fully its extent in the Project Area. Shines (Ref. 4) does not indicate a category for this type but does give the designation "A" for agricultural fields. It is safe to assume that a typical weed flora will be expected around the edges of all the cultivated fields. Shines' (Ref. 4) designations "U" for urban and built up land, and "RD" for recently developed sites would be additional places for weed floras corresponding to the following list:

Allium canadense
Amaranthus graecizans
Ambrosia artemisiifolia
Ambrosia trifida
Anthemis cotula
Aster pilosus
Bidens frondosa
Bidens vulgata
Brassica nigra
Cichorium intybus
Convolvulus arvensis
Daucus carota
Digitaria ischaemum
Echinochloa crus-galli
Eragrostis pectinacea
Erigeron canadensis
Euphorbia supina
Festuca elatior
Hibiscus trionum
Hordeum jubatum
Juncus tenuis
Lychnis alba
Melilotus alba
Melilotus officinalis
Muhlenbergia schreberi
Oxalis stricta
Panicum capillare
Panicum dichotomiflorum
Pastinaca sativa
Plantago lanceolata
Plantago major
Plantago rugellii
Polygonum aviculare
Polygonum erectum
Polygonum pensylvanica
Rumex crispus
Setaria faberii
Setaria glauca
Setaria viridis
Sonchus asper
Sonchus uliginosus
Taraxacum officinalis

Assessment of Habitat Quality

The following criteria have been used in evaluating habitat quality of the plant communities that occur within the Project Area: 1) species diversity; 2) relationship between native and non-native species; and 3) the amount of disturbance as evidenced by species composition.

Species Diversity, as used here, is employed in a qualitative sense and reflects the total number of plant species present in an area. It does not tell anything about the number of individuals of each species. No quantitative data of these kinds were gathered during the study of the flora. The supposition made here concerning species diversity is that communities with a larger number of plant species are intrinsically more valuable, hence of higher quality, than communities composed of just a few species. In using this criterion one must take into consideration the kinds of communities being compared, as for example, wetlands versus uplands. The latter generally support more plant species.

Native versus non-native species comparisons rest on the supposition that communities composed of a greater percentage of indigenous species possess greater quality than those with high percentages of introduced species. Species marked by an asterisk (*) on the species list (Table 6-2) are designated non-native by Fernald (Ref. 2) and Swink and Wilhelm (Ref. 1).

The amount of disturbance reflected in a community is a somewhat subjective evaluation. The supposition is that undisturbed communities are of greater value than disturbed ones. When considered separately, the amount of disturbance does not serve as an accurate indication of the value of some communities as habitat for wildlife. A fencerow community (Type 13), for example, develops in a disturbed environment yet provides excellent habitat for particular types of wildlife. In the discussions that follow I shall confine my evaluations to the amount of disturbance alone without regard for the potential value of the communities as habitat.

All of the aquatic areas that support submerged and emerged vegetation (Community Types 1, 2 & 3) are of high quality. Species diversity is not particularly high when compared with the large number of species comprising the flora of an upland forest, for example, but relatively low numbers of species are typical for permanently wet habitats. The low species diversity is amply balanced by the absence of invasive, non-native plants.

As these community types mature, species diversity can be expected to increase. There are, for instance, several pondweed species that could appear as a result of natural dispersal from nearby populations.

Parts of the three wetland communities considered here have received recent disturbance from siltation, especially in Survey Areas 1 and 4. I think that this kind of disturbance should not be considered permanently damaging to emergent plants, unless it permanently reduces water depth in the future. When the contribution of new silt ceases the vegetation will recover. High turbidity can have detrimental impact on submerged forms of vegetation as it interferes with light penetration.

Species diversity increases slightly in seasonally inundated habitats (Community Types 3 & 4) over that of those that remain constantly inundated. As is the case with wetlands generally, native plant species predominate. Barnyard Grass (Echinochloa crus-galli) is suspected of being introduced. The populations of this species in southwestern Wisconsin probably include both native and Eurasian strains. I saw no signs of its increasing to nuisance levels that might indicate a prevalence of the Eurasian strain. In these community types, even a weedy species is probably kept under control owing to the seasonal inundation that would forestall expansion of annuals such as this one.

Earth-moving and siltation have been the most serious forms of disturbance to these depressions. Such activities are confined to Survey Areas 1 (northeast corner) and 4. Replicates of Community Types 3 and 4 elsewhere seem fairly undisturbed. Though not great in terms of total area, I rank these community types high in quality.

The highest evaluation of habitat quality among wetland communities is given to Community Type 6, meadows around ponds and depressions. No other wetland type surpasses this one in numbers of species. Of the 103 recorded, 98 are native. From my observations, none of the five introduced species has had a deleterious impact on species diversity in the community. One of them, Reed Canary Grass (Phalaris arundinacea) is known to have aggressive tendencies and has been implicated in seriously degrading Community Type 7. The fact that Reed Canary Grass in these meadows seems not to possess aggressive growth characteristics suggests that this strain is the local American one and not the Eurasian strain mentioned by Swink and Wilhelm (Ref. 1).

Meadow vegetation might have been more extensive in the past before attempts were made to drain parcels of land for farming or pasturing. Of those meadows that remain, none shows severe signs of disturbance by the activities of people. Recent earth-moving in areas adjacent to and within Survey Area 1 doubtlessly has obliterated some meadow vegetation.

Habitat quality reaches its lowest among the wetland communities in Community Type 7, river terrace meadows. The reason for this poor evaluation stems from the low species diversity that has resulted from the overabundant growth of Reed Canary Grass (Phalaris arundinacea). Here, as elsewhere in the Upper Midwest, this species has taken hold along streams and grown so vigorously as to obliterate all but the hardiest of meadow plants. This phenomenon is mentioned by Swink and Wilhelm (Ref. 1) who point out that the aggressive characteristics of this species are found in the Eurasian strain, which Curtis (Ref. 5) suggests has a wider ecological amplitude than the native Wisconsin ecotype.

Five of the 33 species of river terrace meadows are non-native. Others are ubiquitous weeds that grow here in response to the disturbance maintained by seasonal flooding. The remainder, the coarsest of meadow species, constitute a minor part of the vegetation.

Ironically, this community type has had little disturbance by people. Its poor evaluation derives principally from its low species diversity.

Reasonably good quality habitat is associated with Community Type 8. Though low in total numbers of species, each replicate of this community seems to have approximately the same mix with no single species outstripping the remainder in growth rates or shading or any other attribute that would tend to depress species diveristy. Only one species is considered non-native: Sow-thistle (Sonchus uliginosus), a plant that in upland habitats has weedy and aggressive tendencies but in wetland areas seems benign.

Where cows graze, muddy margins suffer badly. No grazing activities were observed in the Project Area at the present time, hence, the muddy margins are spared this kind of disturbance.

Community Types 9 and 10, riparian thickets and alluvial woods, are ecologically associated and seem roughly equal in habitat quality. Overall species diversity is not high, with 44 and 39 species recorded for each community type, respectively. Eighteen of the species are found in both community types, consequently only 26 and 21 species, respectively, are used to distinguish the communities. About 10 percent of the species in each community are not indigenous to the area.

Both these community types are subject to natural disturbances, such as flooding, that can alter their floristic composition. Presently only natural disturbances prevail except immediately adjacent to bridge crossings where minor disruption has resulted from fishermen and other sports enthusiasts who attempt to gain access to the river through riparian vegetation.

The prevalence of these community types along the length of the Des Plaines River adds greatly to the total ecological diversity of the Project Area. The two communities alternate with one another to produce a dappled environment that is more diverse in its physiognomy than if only one or the other predominated. In consideration of all these factors, I rate these community types of good quality.

Community Type 11, old fields and roadsides, has the highest number of plant species (151) recorded for any community type recognized in this study. From this aspect alone an old field would seem to possess high habitat quality. But, of the 151 species a full 40 percent (60) are considered non-native, and of the remaining 91 native species, many are the ecological equivalents of the introduced ones; that is to say, they have aggressive and weedy growth characteristics.

Surely the high number of both native and non-native plants in the "old field" flora adds greatly to the total species diversity of the Project Area, and one should not minimize this trait. On balance, however, this community type rates rather low in habitat quality for the reason that its existence, including its high species diversity, is a function of more or less continual disturbance as from plowing, mowing, game keeping, and the like. If protected from disturbance, overall species diversity would decline in these instances while habitat quality would rise as the flora gradually lost its weedy elements.

The tiny prairie remnant (Community Type 12) within the Project Area, on the Hunting Club property, supports only six characteristic prairie plant species and these survive here only because they are perennials. How long they can persist is doubtful since cultivation of the open fields on one side and the encroachment of woodland on the other will slowly bring about their decline. Habitat quality of this community type rates rather low. This becomes particularly apparent when one compares the species number above with the 78 species recorded for the prairie remnant along the railroad tracks just outside the Project Area.

Community Type 13, woodland margins and seral woodlands, supports 98 species of which 15 are considered non-native. Among these 15 are a few perennials that persist in seral areas during the ecological change from an open to a shaded community. Only three of the non-native species would be expected to remain as components of a woodland flora when this change is complete (see evaluation of Community Type 14). Free from disturbance, this community type will improve as native species gradually replace introduced ones. This process is most evident in the patches of seral woodlands that are not contiguous with cultivated fields.

The prospects for habitat improvement and the relatively high species diversity combine to produce a high rating of habitat quality of this community type.

Deciduous forest, Community Type 14, ranks highest in habitat quality. Of the 93 species recorded from upland deciduous forests in the Project Area, only three are not indigenous. As stated previously, I believe that all of the elements of the native forest flora are still present in the area, only their relative numbers have changed. For example, past grazing practices may have contributed to a rise in the number of individuals of Wild Gooseberry (Ribes missouriense) and, at the same time caused the decline, without complete extirpation, of some other species. While such disturbances can account for present representations of species, most of the forested areas observed in this study showed signs of recovering from past abuse. The evidence for this is the good reproduction of the dominant tree species.

Two factors persist to bring about a certain amount of habitat degradation in the forests of the Project Area: 1) the continued reproduction and increase of two nuisance species, Common Buckthorn (*Rhamnus cathartica*) and Honeysuckle (*Lonicera tartarica*); and 2) disturbance from road building and continued use of existing roads. The first is a problem in forests throughout the Upper Midwest where these two shrub species have invaded. It is doubtful that natural succession of mature forest can completely force them out. They have probably become permanent components of the flora. In the case of the latter, recovery can begin as soon as road building and use cease.

Weed communities (Type 15) rank lowest in habitat quality. A remarkably large number of species (85) find room to grow in disturbed areas along walks, paths, roadways, foundations, etc., but of these only 20 are native to southwestern Wisconsin. As is the case with many native species of old fields (Community Type 11), among the 20 considered here are some of the most weedy and aggressive plants of the indigenous flora. Weed habitats thrive on disturbance. Persistent development, farming, and recreation activities in the Project Area will assure the survival of this community type.

Composite Species List for the Project Area

Table 6-2 lists every vascular plant species observed in the Project Area. The arrangement is alphebetical by the Latin binomials. Each entry includes the genus, species, vernacular name(s) and a mark (x) in the column(s) representing the community type(s) where the species occurred. The community types are designated by numbers that correspond to those used in the text.

Nomenclature follows that of Swink and Wilhelm (Ref. 1). The vernacular names for the most part are from Swink and Wilhelm but in a few instances I substituted names heard in use by persons dwelling in the Project Area. These English names have apparently not yet found their way into the botanical literature. An example is the one used for *Trillium recurvatum* that Swimk and Wilhelm call Red Trillium but is regionally known as Bloody Noses.

Endangered and Threatened Plants

Table 6-3 provides a list of plant species considered endangered or threatened in the state of Wisconsin. This updated (1979) compendium was provided by the Wisconsin Department of Natural Resources. The nomenclature follows the usage by that agency. None of the listed species were observed in the Project Area.

Two species listed in Table 6-2 are considered as rare and are here reported for the first time as additions to the known flora of Kenosha County (see Ref. 1). These are Carex atherodes and Dracocephalum parviflorum. Neither appears on the threatened or endangered list (Table 6-3).

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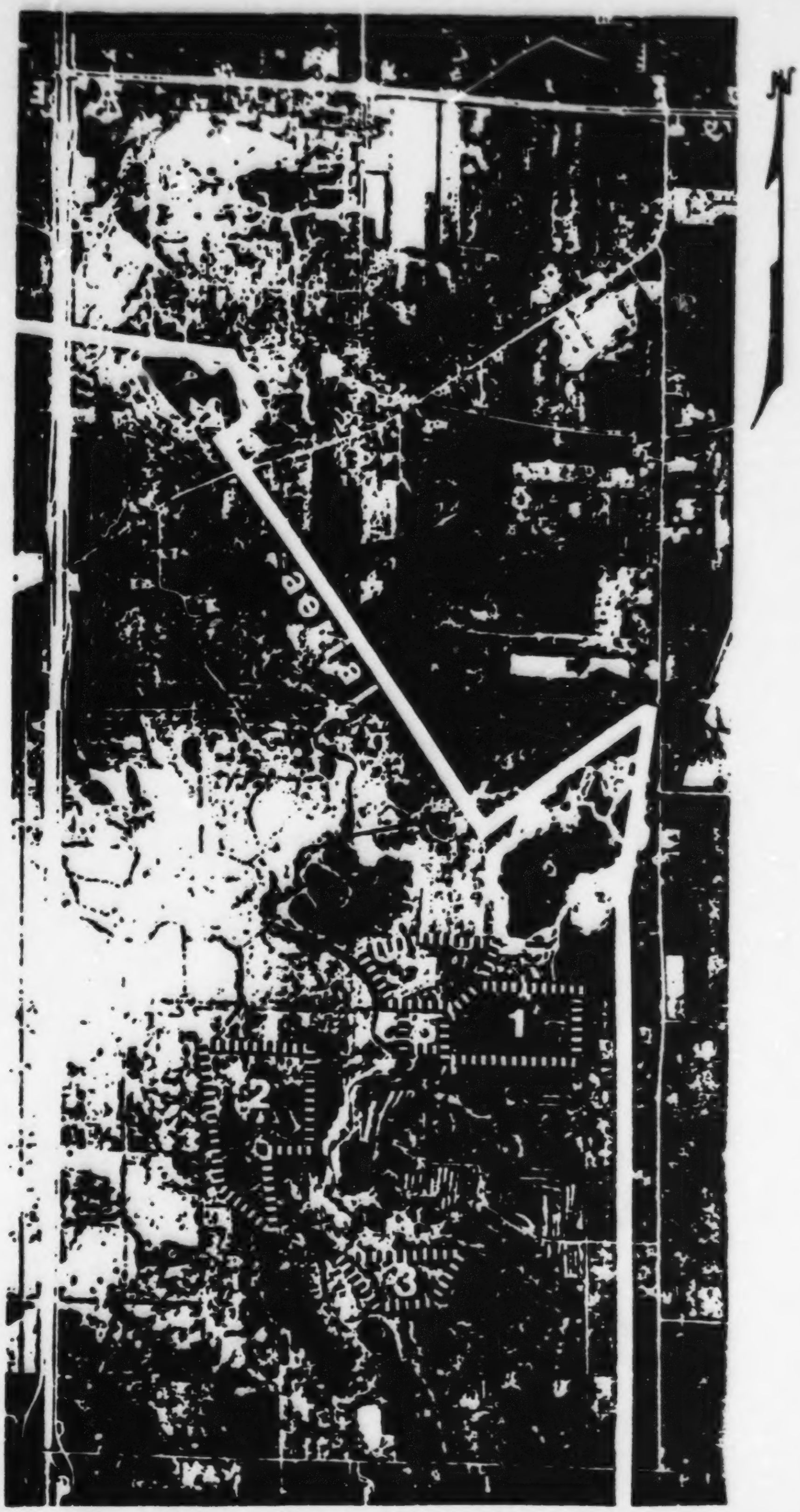

Figure 6-1. Survey Areas 1-5 referred to in Plant Section. These are the same areas covered during the bird study.

Table 6-1. Dates of plant surveys, 1980.

TRIP #	DATE	PRINCIPAL SITE(S) VISITED
1	3-5 May	Quarry woods Hunt club woods
2	12 June	Hunt club Des Plaines R. at jct. with Co. Hwy. C Girl Scout camp
3	14 June	Des Plaines River (canoe)
4	4 July	Marshes, dikes, and adjoining areas - Survey Areas 1, 4 & 5
5	6 July	Marshes - Girl Scout camp
6	27 July	Hunt club, Girl Scout camp
7	2-3 August	Hunt club
8	23-24 August	Survey Area 5 Quarry woods
9	8 September	Girl Scout camp Prairie along railroad
10	15 September	SE portion of Project Area (S of hunt club)
11	21 September	Survey Areas 1 & 4 Prairie along railroad
[redacted]	5 October	Upland areas of Girl Scout camp

Table 6-2. Vascular plants of the Des Plaines River Project Area.

Species	Community Type														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Abutilon theophrasti Velvet Leaf, Button Weed															x
Acalypha rhomboidea Three-seeded Mercury															x
Acer negundo Box-elder								x	x	x	x		x		
Acer saccharinum Silver Maple		x							x	x					
Acer saccharum Sugar Maple														x	
Achillea millefolium Yarrow, Milfoil											x	x	x		x
Acnida altissima Water-hemp				x	x	x	x	x							
Acorus calamus Sweet Flag		x				x									
Actea rubra Red Baneberry														x	
Agrimonia gryposepala Agrimony													x	x	
Agrimonia pubescens Agrimony													x	x	
Agropyron repens Quack Grass											x	x			
Agrostis alba Red Top, Bent Grass											x	x	x		x
Alisma subcordatum Water-plantain		x		x		x		x							
Alisma triviale Water-plantain		x				x									
Allium canadense Wild Onion										x	x	x	x	x	
Allium cernuum Nodding Onion												x			
Allium tricoccum Wild Leek										x				x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Amaranthus graecizans** Creeping Amaranth											x				x
*Amaranthus hybridus** Green Amaranth											x				x
Ambrosia artemisiifolia Ragweed											x	x	x		x
Ambrosia trifida Giant Ragweed									x	x	x	x	x		x
Amphicarpa bracteata Hog-peanut													x	x	
Andropogon gerardi Big Blue Stem												x			
Anemone canadensis Meadow Anemone						x						x	x		
Anemonella thalictroides Wood-rue														x	
*Anthemis cotula** Dog-fennel															x
Apios americana Ground Nut												x			
Apocynum cannabinum Indian-hemp, Dogbane											x	x			
Apocynum sibiricum Indian-hemp, Dogbane						x									
Aralia nudicaulis Wild Sarsaparilla														x	
*Arctium minus** Burdock															x
Arisaema atrorubens Jack-in-the-pulpit														x	
Asclepias incarnata Marsh Milkweed		x		x		x	x	x							
Asclepias syriaca Milkweed											x	x	x		x
Asclepias verticillata Whorled Milkweed											x	x			x

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Asparagus officinalis** Asparagus											x	x	x		
Aster ericoides Heath Aster												x			
Aster laevis Smooth Aster												x			
Aster pilosus Downy Aster				x							x	x	x		
Aster simplex Aster				x		x									
Aster sagittifolius Blue Aster												x	x		
Athyrium filix-femina Lady Fern														x	
*Atriplex patula** Common Orach															x
*Barbarea vulgaris** Yellow Rocket															x
Bidens cernua Beggar's Ticks				x		x		x							
Bidens connata Beggar's Ticks		x				x		x							
Bidens frondosa Spanish Needles				x							x				x
Bidens vulgata Spanish Needles			x								x				x
Boehmeria cylindrica False-nettle					x	x			x	x					
Boltonia latisquama False-aster				x		x									
*Brassica nigra** Field Mustard											x				x
*Bromus inermis** Hungarian Brome											x	x			
Bromus purgans Woodland Brome														x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Calamagrostis canadensis **Blue Joint**						x	x	x							
Campanula americana **Tall Bellflower**													x	x	
Campanula aparinoides **Marsh Bellflower**						x		x							
*Capsella bursa-pastoris** **Shepherd's Purse**											x				
Cardamine pensylvanica **Bitter Cress**						x		x	x						
*Carduus nutans** **Musk-thistle**											x				x
Carex atherodes **Sedge**						x									
Carex blanda **Sedge**													x	x	
Carex cephalophora **Sedge**														x	
Carex haydenii **Sedge**		x				x	x		x						
Carex hystricina **Sedge**		x													
Carex lanuginosa **Sedge**						x									
Carex normalis **Sedge**						x									
Carex rosea **Sedge**														x	
Carex sparganioides **Sedge**													x	x	
Carex cf. stricta **Sedge**					x										
Carex tribuloides **Sedge**														x	
Carex vulpinoidea **Sedge**													x		

Table. 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Carya cordiformis Yellow-bud Hickory													x	x	
Carya ovata Shagbark Hickory													x	x	
Caulophyllum thalictroides Blue Cohosh														x	
Ceanothus americanus New Jersey-tea												x			
Celastrus scandens Bittersweet												x	x	x	
Ceratophyllum demersum Hornwort, Coontail	x														
*Chenopodium album** Lamb's Quarter											x				x
*Chrysanthemum leucanthemum** Ox-eye Daisy											x	x			x
*Cichorium intybus** Chicory											x				x
Cicuta bulbifera Water-hemlock		x				x									
Cicuta maculata Water-hemlock		x				x		x							
Circaea quadrisulcata Enchanter's-nightshade															x
Cirsium arvense Canada Thistle						x	x	x	x	x	x	x	x		x
Cirsium vulgare Bull Thistle						x					x	x			x
Claytonia virginica Spring Beauty										x				x	
*Convolvulus arvensis** Field Bindweed						x					x		x		x
Convolvulus sepium Hedge Bindweed											x		x		
Cornus racemosa Gray Dogwood						x						x	x	x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cornus stolonifera Red Osier		x			x	x									
*Coronilla varia** Crown-vetch												x			x
Corylus americana Hazel Nut													x	x	
Crataegus coccinea Hawthorne							x		x		x		x		
Crataegus crus-galli Cockspur Hawthorne											x		x	x	
Crataegus margaretta Hawthorne													x		
Crataegus mollis Downy Hawthorne													x		
Crataegus punctata Hawthorne									x				x		
Cryptotaenia canadensis Honewort														x	
Cuscuta polygonorum Dodder									x						
Cyperus erythrorhizus Umbrella Sedge				x		x		x							
Cyperus esculentus Chufa								x			x				
Cyperus strigosus Umbrella Sedge								x							
*Dactylis glomerata** Orchard Grass											x				x
*Daucus carota** Queen Anne's Lace, Carrot						x	x	x		x	x				x
Dentaria laciniata Toothwort														x	
Desmodium canadense Showy Tick Trefoil											x	x			
Desmodium glutinosum Tick Trefoil														x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Dianthus armeria** Depthford Pink											x				x
Dicentra cucullaria Dutchman's Britches														x	
*Digitaria ischaemum** Smooth Crab Grass															x
*Digitaria sanguinalis** Hairy Crab Grass											x				x
Dioscorea villosa Wild Yam													x	x	
*Dipsacus sylvestris** Common Teasel											x				
Dodecatheon meadia Shooting Star										x				x	
Dracocephalum parviflorum American Dragonhead				x							x				
Echinochloa crusgalli Barnyard Grass				x							x				x
Echinochloa walteri Salt Marsh Cockspur Grass				x											
Echinocystis lobata Wild-cucumber													x		
Eleocharis acicularis Needle Spike-rush								x							
Eleocharis calva Spike-rush		x				x		x							
Eleocharis compressa Spike-rush		x				x		x							
Eleocharis palustris Spike-rush		x				x		x							
Elymus canadensis Wild Rye												x			
Elymus virginicus Wild Rye						x					x	x			
Epilobium coloratum Cinnamon Willow Herb				x		x									

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Epilobium glandulosum Willow Herb						x									
Equisetum arvense Scouring-rush, horsetail						x	x	x	x	x	x	x	x		
Equisetum fluviatile Pipes		x													
*Eragrostis pectinacea** Love Grass															x
Erechtites hieracifolia Fireweed						x		x							
Erigeron annuus Annual Fleabane											x				
Erigeron canadensis Muletail											x		x		x
Erigeron philadelphicus Marsh Fleabane											x		x		
Erigeron strigosus Fleabane-daisy				x		x		x			x				x
Erythronium albidum Dog-tooth-violet, Trout Lily										x				x	
Eupatorium altissimum Thoroughwort												x			
Eupatorium perfoliatum Boneset					x	x		x							
Euphorbia corollata Flowering Spurge												x			
*Euphorbia supina** Prostrate Spurge															x
*Fagopyrum sagittatum** Buckwheat											x				
*Festuc elatior ** Meadow Fescue							x				x				
Festuca obtusa Nodding Fescue														x	
Fragaria virginiana Wild Strawberry									x		x	x	x		

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fraxinus americana **White Ash**													x	x	
Fraxinus pennsylvanica **Green Ash**											x		x		
Galium aparine **Cleavers, Annual Bedstraw**								x	x	x	x		x		
Galium circaezans **Wild-licorice**										x				x	
Galium concinnum **Shining Bedstraw**														x	
Galium obtusum **Wild Madder**						x		x							
Galium tinctorium **Stiff Bedstraw**		x				x		x							
Geranium maculatum **Cranesbill, Wild Geranium**												x	x	x	
Geum canadense **White Avens**									x	x			x		
Geum laciniatum **Rough Avens**						x	x	x	x						
*Glechoma hederacea** **Creeping Charlie, Ground-ivy**										x					x
Glyceria striata **Manna Grass**		x													
Gnaphalium obtusifolium **Old-field Balsam, Everlasting**											x				
Hackelia virginiana **Stickseed**									x	x					
Helianthus grosseserratus **Sunflower**												x	x		
Helianthus laetiflorus **Prairie Sunflower**												x			
Helianthus strumosus **Woodland Sunflower**												x	x		
Heliopsis helianthoides **Ox-eye-daisy**												x			

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Hemerocallis fulva** Orange Day Lily											x				x
Hepatica acutiloba Hepatica														x	
Heteranthera dubia Water Star-grass	x														
*Hibiscus trionum** Flower-of-an-hour											x				x
*Hieracium aurantiacum** Orange Hawkweed											x				
Hieracium canadense Canada Hawkweed											x				
Hierochloë odorata Vanilla Grass						x									
*Hordeum jubatum** Squirrel-tail Grass											x				x
Hydrophyllum virginianum Waterleaf										x				x	
Hypericum perforatum St. John's Wort											x		x		
Hystrix patula Bottle Brush Grass														x	
Impatiens capensis Spotted Touch-me-not				x		x	x	x							
Impatiens pallida Touch-me-not					x				x						
Iris virginica Blue Flag					x	x	x	x	x						
Isopyrum biternatum False Rue-anemone										x				x	
Juglans nigra Black Walnut													x	x	
Juncus dudleyi Rush						x									
Juncus tenuis Path Rush											x		x		

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Juncus torreyi Rush												x			
Lactuca canadensis Wild Lettuce						x	x	x			x		x		
*Lactuca scariola** Prickly Lettuce											x				x
Laportea canadensis Wood Nettle										x				x	
Lathyrus palustris Marsh-pea						x									
Leersia oryzoides Rice Cut Grass		x			x	x	x	x							
Lemna minor Small Duckweed	x	x													
Lemna trisulca Forked Duckweed	x	x	x												
*Leonurus cardiaca** Motherwort													x		x
*Lepidium campestre** Field Cress											x		x		x
*Lepidium densiflorum** Small Peppercress											x				x
*Linaria vulgaris** Butter-n-eggs											x				x
Lobelia spicata Blue Lobelia						x		x							
Lobelia syphilitica Giant Lobelia		x						x							
Lonicera prolifera Yellow Honeysuckle											x				
*Lonicera tatarica** Tartarian Honeysuckle											x		x	x	x
Ludwigia palustris Marsh Purslane	x	x													
*Lychnis alba** White Campion, Evening Lychnis											x	x	x		x

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Lycopus americana Water-horehound		x				x	x	x							
*Lysimachia nummularia** Moneywort										x					
Lysimachia quadriflora Loosestrife						x									
Lysimachia terrestris Tufted Loosestrife						x			x	x					
Lythrum alatum Winged Loosestrife												x			
*Malva neglecta** Cheeses															x
*Matricaria matricarioides** Pineapple Weed											x				x
*Medicago lupulina** Black Medic											x				x
*Medicago sativa** Alfalfa											x				x
*Melilotus alba** White Sweet Clover											x		x		
*Melilotus officinalis** Yellow Sweet Clover											x		x		x
Menispermum canadense Moonseed														x	
Mentha arvensis Wild Mint		x		x	x	x		x							
Mimulus ringens Monkey Flower								x							
*Mirabilis nyctaginea** Wild Four O'Clock											x				x
Monarda fistulosa Wild Bergamot, Horsemint											x	x	x		
*Morus alba** Mulberry						x							x	x	
*Muhlenbergia schreberi** Nimble-will											x				x

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Myriophyllum exalbescens Water-milfoil	x														
Najas flexilis Slender Naiad	x														
*Nepeta cataria** Catnip											x		x		x
Nuphar advena Spatterdock	x	x													
Nymphaea tuberosa White Water-lily	x	x													
Oenothera biennis Evening-primrose											x	x			
Onoclea sensibilis Sensitive Fern														x	
Osmorhiza claytoni Hairy Sweet Cicely													x	x	
Osmorhiza longistylis Sweet Cicely, Wild-licorice													x	x	
Osmunda claytoniana Interrupted Fern														x	
Ostrya virginiana Hop Hornbeam, Ironwood														x	
Oxalis europea Tall Wood Sorrel											x				
Oxalis stricta Wood Sorrel											x				x
Panicum capillare Fall Panicum											x				x
Panicum dichotomiflorum Barnyard Panicum				x							x				x
Panicum cf. implicatum Panic Grass												x			
Panicum virgatum Switch Grass												x			
Parietaria pensylvanica Pellitory								x		x				x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Parthenocissus quinquefolia Virginia Creeper													x	x	
Parthenocissus vitacea Virginia Creeper													x		
*Pastinaca sativa** Wild Parsnip															x
*Phalaris arundinacea** Reed Canary Grass		x		x		x	x	x	x						
*Phleum pratense** Timothy											x				x
Phragmites communis Common Reed		x				x	x	x							
Phryma leptostachya Lopseed														x	
Physalis heterophylla Clammy Ground-cherry											x				
Physalis subglabrata Tall Ground-cherry						x					x				
Physocarpus opulifolius Ninebark						x			x						
Physostegia parviflora Obedient Plant				x		x									
Pilea pumila Clearweed											x			x	
*Plantago lanceolata** English Plantain															x
*Plantago major** Common Plantain											x				x
Plantago rugellii Red-stalked Plantain											x				x
*Poa compressa** Canada Blue Grass											x	x			
Poa palustris Marsh Blue Grass		x				x			x						
*Poa pratensis** Kentucky Blue Grass						x		x	x		x	x	x		

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Podophyllum peltatum **May-apple**														x	
Polemonium reptans **Jacob's Ladder**														x	
Polygonatum cannaliculatum **Solomon's Seal**						x							x	x	
Polygonum amphibium **Water Knotweed**		x	x	x		x	x								
*Polygonum aviculare** **Common Knotweed**															x
Polygonum coccineum **Water Heartsease**		x	x	x		x	x								
Polygonum erectum **Erect Knotweed**															x
Polygonum hydropiperoides **Water-pepper**		x	x	x		x									
Polygonum lapathifolium **Heartsease**						x									
Polygonum pensylvanicum **Knotweed**											x				x
*Polygonum persicaria** **Lady's Thumb**															x
Polygonum sagittatum **Tear Thumb**						x									
Polygonum scandens **Climbing-buckwheat**													x		
Pontederia cordata **Pickerel Weed**		x													
Populus deltoides **Cottonwood**		x							x	x					
Populus grandidentata **Large-tooth Aspen**										x				x	
Populus tremuloides **Quaking Aspen**									x	x					
*Portulaca oleracea** **Purslane**															x

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Potamogeton foliosus Pondweed	x														
Potamogeton pectinatus Pond-sago	x														
Potentilla norvegica Rough Cinquefoil						x		x	x		x	x	x		
Potentilla recta Sulfur Cinquefoil											x	x	x		
Potentilla simplex Common Cinquefoil						x									
Prenanthes alba Lion's Foot														x	
Proserpinaca palustris Mermaid Weed	x	x													
Prunus americana Wild Plum											x		x		
Prunus serotina Wild Black Cherry											x		x	x	
Prunus virginiana Choke Cherry											x		x	x	
*Prunella vulgaris** Self Heal											x				x
Pycnanthemum virginianum Common Mountain Mint												x			
Pyrus ioense Wild Crab Apple, Iowa Crab											x		x		
Quercus alba White Oak													x	x	
Quercus ellipsoidalis Hill's Oak													x	x	
Quercus macrocarpa Bur Oak						x					x		x	x	
Quercus rubra Red Oak														x	
Quercus velutina Black Oak													x	x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ranunculus abortivus Small-flowered Crowfoot								x	x	x			x		
*Ranunculus acris** Tall Buttercup											x				
Ranunculus fascicularis Early Buttercup											x		x		
Ranunculus longirostris Stiff Water Crowfoot	x														
Ranunculus pensylvanicus Bristly Buttercup		x				x									
Ranunculus sceleratus Cursed Buttercup								x							
Ranunculus septentrionalis Swamp Buttercup						x				x				x	
Ratibida pinnata Yellow Coneflower											x	x			
*Rhamnus cathartica** Common Buckthorn						x	x		x	x	x	x	x	x	x
Rhus glabra Smooth Sumac													x		
Rhus radicans Poison-ivy						x							x	x	
Ribes americanum Wild Black Currant						x							x		
Ribes missouriense Gooseberry													x	x	
Robinia pseudo-acacia Black Locust										x	x				
Rorripa islandica Marsh Cress							x								
Rosa arkansana Sunchine Rose												x			
Rosa blanda Early Wild Rose						x	x	x							
Rosa carolina Pasture Rose												x			

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Rosa multiflora** Multiflora Rose												x	x		x
Rubus allegheniensis Blackberry											x		x	x	
Rubus occidentalis Raspberry											x		x	x	
Rudbeckia hirta Black-eyed Susan											x				
Rudbeckia laciniata Wild Golden Glow										x					
Rumex altissimus Pale Dock		x		x		x			x						
*Rumex crispus** Curly Dock											x	x	x		x
Rumex orbiculatus Great Water Dock		x													
Rumex verticillatus Swamp Dock		x													
Sagittaria brevirostrata Duck-potato		x													
Sagittaria latifolia Common Arrowhead		x													
*Salix alba** White Willow									x	x					
Salix amygdaloides Peach-leaved Willow									x	x					
Salix bebbiana Beaked Willow						x			x						
*Salix fragilis** Crack Willow									x						
Salix gracilis Petioled Willow		x				x		x	x						
Salix interior Sandbar Willow		x			x	x	x	x	x			x			
Salix nigra Black Willow									x	x					

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Salix rigida Willow						x			x			x			
Sambucus canadensis Elderberry						x			x				x		
Sanicula gregaria Black Snakeroot														x	
*Saponaria officinalis** Bouncing Bet, Soapwort											x	x			x
Scirpus acutus Hard-stemmed Bulrush		x	x			x	x	x							
Scirpus atrovirens Common Bulrush		x				x					x				
Scirpus cyperinus Wool-grass		x				x									
Scirpus fluviatilis River Bulrush		x	x			x									
Scirpus lineatus Red Bulrush				x								x			
Scirpus validus Great Bulrush		x	x			x	x								
Scrophularia lanceolata Figwort												x			
Scutellaria epilobiifolia Marsh Skullcap		x						x							
Scutellaria lateriflora Mad-dog Skullcap		x						x							
Senecio plattensis Prairie Ragwort											x				
*Setaria faberii** Giant Foxtail											x				x
*Setaria glauca** Yellow Foxtail											x				x
*Setaria viridis** Green Foxtail											x				x
Silene stellata Starry Campion														x	

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Silphium integrifolium Rosin Weed												x			
Silphium terebinthinaceum Prairie-dock												x			
Sium suave Water-parsnip		x		x											
Smilacina racemosa False Solomon's Seal													x	x	
Smilacina stellata False Solomon's Seal												x	x		
Smilax ecirrhata Carrion Flower											x	x		x	
Smilax herbacea Carrion Flower												x			
*Solanum dulcamara** Bittersweet Nightshade					x	x			x		x		x		
Solidago altissima Tall Goldenrod						x						x	x		
Solidago gigantea Late Goldenrod						x						x			
Solidago graminifolia Meadow Goldenrod						x									
Solidago ridellii Goldenrod						x						x			
Solidago rigida Stiff Goldenrod												x			
*Sonchus asper** Spiny Sow-thistle											x				x
*Sonchus uliginosus** Common Sow-thistle						x	x	x			x				x
Sorghastrum nutans Indian Grass												x			
Sparganium eurycarpum Common Bur Reed		x													
Spartina pectinata Slough Grass, Cord Grass		x				x									

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sphenopholis intermeadia Wedge Grass						x		x							
Spiraea alba Meadowsweet						x	x								
Spiranthes cernua Nodding Ladie's Tresses												x			
Spirodela polyrhiza Great Duckweed	x	x													
Sporobolus cryptandrus Sand Dropseed												x			
Sporobolus vaginiflorus Small Rush Grass												x			x
Stachys palustris Woundwort				x		x									
Stachys tenuifolia Hedge-nettle						x							x		
*Stellaria media** Common Chickweed															x
Taenidia integerrima Yellow Pimpernel										x					
*Taraxacum officinalis** Dandelion											x				x
Teucrium canadense Germander									x		x		x		
Thalictrum dasycarpum Meadow Rue		x				x		x	x						
Thalictrum dioicum Early Meadow Rue														x	
*Thlaspi arvense** Penny Cress															x
Tilia americana Basswood														x	
Tovara virginiana Jumpseed										x				x	
Tradescantia ohiensis Spiderwort, Widow's Tears											x	x			

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
*Tragopogon major** Goat's Beard											x				x
*Trifolium hybridum** Alsike Clover											x				
*Trifolium pratense** Red Clover											x				x
*Trifolium repens** White Clover											x				
Trillium flexipes White Trillium														x	
Trillium recurvatum Bloody Noses										x				x	
Triosteum aurantiacum Horse-gentian														x	
Typha angustifolia Narrow-leaved Cat-tail		x				x	x	x							
Typha latifolia Common Cat-tail		x				x	x	x							
Ulmus americana Common Elm											x			x	
Ulmus rubra Slippery Elm											x			x	
Urtica procera Tall Nettle		x				x	x	x	x		x				
Utricularia vulgaris Great Bladderwort	x														
*Verbascum blattaria** Moth Mullein											x				
*Verbascum thapsus** Common Mullein											x				
Verbena hastata Blue Vervain						x	x	x			x				
Verbena urticifolia White Vervain											x		x	x	
Vernonia fasciculata Common Ironweed				x		x	x								

Table 6-2. Cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Veronica peregrina Speedwell				x						x	x				
Veronicastrum virginicum Culver's Root												x	x	x	
Viburnum lentago Nannyberry													x	x	
Viburnum rafinesquianum Arro-wood						x							x	x	
Viola papilionacea Common Blue Violet									x	x			x	x	
Viola pensylvanica Yellow Violet														x	
Viola sororia Hairy Wood Violet										x				x	
Vitis riparia Wild Grape							x		x	x			x		
Wolffia columbiana Common Water Meal	x														
*Xanthium strumarium** Cocklebur												x			x
Xanthoxylum americanum Prickly-ash														x	
Zizia aurea Golden Alexander						x						x			

* Non-native, introduced species

Table 6-3. Endangered and threatened plant species of Wisconsin.

ENDANGERED SPECIES

Anemone multifida - no common name (Ranunculaceae)
Arenaria macrophylla - no common name (Caryophyllaceae)
Armoracia aquatica - Lake Cress (Brassicaceae)
Asplenium viride - Green Spleenwort (Polypodiaceae)
Astragalus alpinus - Alpine Milk Vetch (Fabaceae)
Caltha natans - a Marsh Marigold (Ranunculaceae)
Carex lupuliformis - no common name (Cyperaceae)
Carex media - no common name (Cyperaceae)
Collinsonia canadensis - Stoneroot (Lamiaceae)
Conioselinum chinense - Hemlock-parsley (Apiaceae)
Draba lanceolata - no common name (Brassicaceae)
Eleocharis quadrangulata - a Spike-rush (Cyperaceae)
Eleocharis wolfii - a Spike-rush (Cyperaceae)
Erigenia bulbosa - Harbinger-of-spring (Apiaceae)
Fimbristylis puberula - no common name (Cyperaceae)
Geocaulon lividum - Northern-commandra (Santalaceae)
Geum macrophyllum - Large-leaved Avens (Rosaceae)
Listera auriculata - Auricled Twayblade (Orchidaceae)
Parnassia parviflora - a Grass-of-Parnassus (Saxifragaceae)
Plantago cordata - Heart-leaved Plantain (Plantaginaceae)
Polygala incarnata - Pink Milkwort (Polygalaceae)
Prenanthes crepidinea - Great White Lettuce (Asteraceae)
Pterospora andromeda - Pine Drops (Ericaceae)
Pyrola minor - Small Shinleaf (Ericaceae)
Rhododendron lapponicum - Lapland Rosebay (Ericaceae)
Ruellia humilis - Wild Petunia (Acanthaceae)
Salix cordata - Sand Dune Willow (Salicaceae)
Tanacetum huronense - Lake Huron Tansy (Asteraceae)
Thaspium barbinode - Hairy Meadow Parsnip (Apiaceae)
Vaccinium cespitosum - Dwarf Bilberry (Ericaceae)
Vaccinium vitis-idea - Mountain Cranberry (Ericaceae)
Viburnum edule - Squashberry (Caprifoliaceae)
Viola fimbriatula - a Violet (Violaceae)

THREATENED SPECIES

Aconitum novaboracense - Northern Monkshood (Ranunculaceae)
Carex concinna - no common name (Cyperaceae)
Carex lenticularis - Lenticular Sedge (Cyperaceae)
Cirsium pitcheri - Dune Thistle (Asteraceae)
Cypripedium arietinum - Ram's-head Lady's-slipper (Orchidaceae)
Cypripedium candidum - White Lady's-slipper (Orchidaceae)
Drosera angelica - a Sundew (Droseraceae)
Drosera linearis - a Sundew (Droseraceae)

Table 6-3, cont.

Festuca occidentalis - Western Fescue (Poaceae)
Fraxinus quadrangulata - Blue Ash (Oleaceae)
Habenaria flava var. *herbiola* - Tubercled Orchid (Orchidaceae)
Habenaria leucophaea - Prairie White-fringed Orchid (Orchidaceae)
Iris lacustris - Dwarf Lake Iris (Iridaceae)
Lespedeza leptostachya - Prairie Bush-clover (Fabaceae)
Opuntia fragilis - Brittle Prickly-pear (Cactaceae)
Orchis rotundifolia - Small Round-leaved Orchis (Orchidaceae)
Oryzopsis campestris var. *chartacea* - no common name (Fabaceae)
Parnassia palustris - a Grass-of-Parnassus (Saxifragaceae)
Potamogeton confervoides - no common name (Potamogetonaceae)
Polytaenia nuttallii - a Prairie-parsley (Apiaceae)
Solidago spathulata var. *gillmani* - Dune Goldenrod (Asteraceae)
Trillium nivale - Snow Trillium (Liliaceae)
Viola novae-angliae - a Violet (Violaceae)

PART 7: EVALUATION OF THE DES PLAINES RIVER WETLAND: AN OVERVIEW

William E. Southern, Ph.D.

WILDLIFE AND FISHERIES VALUE

During the project period (October 1979-November 1980), the following resources were inventoried on the Des Plaines River wetlands near Kenosha, Wisconsin (the Project Area): wildlife, fishes, invertebrates and vegetation. These studies were designed to determine 1) the species present in the area; 2) the relative abundance of species found (except for plants); and 3) the quality of the Project Area as fish and wildlife habitat, now and in the future. Parts 2-6 of this report describe the biological inventories that were conducted. Each part includes an evaluation of habitat quality as it pertains to the particular group of organisms being discussed (e.g. birds, fishes, etc.).

The data collected for each of the taxonomic categories listed above indicate conclusively that the Project Area contains quality habitat for typical wetland species of birds (73 species), mammals (13), amphibians (5), and reptiles (5). In addition, the area supports a diversified fish fauna (32 species), including 10 game species. Six game and 13 nongame fish species reproduce on the area. The fish and wildlife populations are directly or indirectly dependent upon the vegetation (408 plant species) and invertebrates (at least 80 taxa) found on the area for their survival; consequently the abundance of fishes and wildlife is a reflection of the quality of these communities.

The Des Plaines River wetlands provide an important stopping place for migrant waterfowl (19 species) and other species of waterbirds (19) during both spring and fall migration. The total number of avian species (173) and the number of individual birds recorded on the area is impressive. A few species of ducks breed on the area and potentially others could. Several species of marsh birds that are declining in abundance (e.g. Common Gallinule, Black Tern) nest on the Project Area. The presence of these forms is further evidence that portions of the wetlands are of sufficient character and quality to satisfy their specific habitat requirements. Because of the diversity of habitats available over the Project Area, an extensive species list has been established for the area;

some of these birds use open-water marshes, some use transition areas and others use the wooded portions of the floodplain. In general, high species richness in any of the faunal groups (i.e. species number) can be equated with high productivity in the marshes on the Project Area; consequently, species number, particularly in the case of birds, fishes and plants, indicates the Project Area habitats are of good quality.

It has been shown (Ref. 1) that the number of bird nests in marshes is positively correlated with the number of plant communities present. Thus the diversified nature of the Project Area, as evidenced by the number of plant communities identified (15), increases the probability that a large number of birds and other wildlife will find the area suitable for their needs. In the marshes proper, the interspersion of several plant zones, rather than extensive homogeneous stands, benefits wildlife (Ref. 1). Larger duck nesting populations, for example, have been reported (Ref. 2) in broken stands than in solid stands of emergent vegetation. In general, wetland heterogeneity is considered important to waterfowl productivity (Ref. 3). This applies to use of an area by waterfowl during migration as well as during the breeding season. Many species of marsh birds, such as Black Terns, nest near water-cover interfaces (Ref. 4) that are prevalent in portions of the Project Area. Most species favor marshes that are in a "hemi-marsh" stage with a ratio of about 1:1 cover to water interspersion (Ref. 5). A positive correlation also has been noted (Ref. 6) between bird species and the proportional amount of open water or the number of openings within the emergent cover. Marshes with complex plant zonation have several heights or layers of vegetation and open water acts as another layer. This combination of characteristics attracts swimming birds that feed in the open but use the cover or edge for nesting (Ref. 5). Most birds select nesting areas on the basis of plant structure rather than the taxonomic composition of a stand of emergent vegetation. Yellow-headed Blackbirds, for example, may use cattail, river bulrush, reeds or small willows for nests provided such stands are in water and adjacent to open water (Ref. 5).

Plants are important sources of food for wildlife. Many species that nest in deep open water communities may feed in wet meadows because the plants there are better food sources than cattails. Emergent plants are important to many birds and to muskrats as food but the submergent plants provide the substrates for invertebrates that serve as food for ducks (Ref. 7). Consequently, plant community diversity is essential to high wildlife diversity and productivity on the area. The Project Area offers good diversity and is of unquestionable value to fishes and wildlife. Its importance for this purpose is intensified when placed in perspective with the scarcity of comparable areas in the region (southeastern Wisconsin or northeastern Illinois). The size of the area as well as its geographic location increases its value as wildlife habitat because comparable areas are becoming increasingly rare in this part of the Midwest.

Size of a wetland is vital to maintenance of a marsh fauna, especially when the marsh is a relict (Ref. 5). Evidence exists showing a typical wildlife fauna can be preserved in wetlands of about 240 acres (100 hectares) in size (Ref. 5). Because smaller areas are less attractive or even unattractive to marsh species, continued survival of marsh birds on a regional basis is dependent upon the few remaining large tracts of wetlands that retain their integrity. The Project Area is sufficiently large to satisfy this requirement.

Marshes usually are constantly changing in response to water regimes, temperature extremes and other variables. Such changes often reverse plant succession, thereby extending the life of a marsh system. Because of this, marshes exist for long periods, ecologically speaking, if they are not drained or filled by man for agriculture or other purposes. Short-term changes in water levels may have dramatic effects on plant growth and distribution. Many emergent plants (e.g. cattail) germinate only in shallow water or on mud flats, and revegetation of an open marsh occurs rapidly only when water levels are low (Ref. 5). Even vegetative reproduction of cattail is more pronounced in low water depths (Ref. 8). As a result, deep basins with relatively stable water levels remain open as vegetative propagation does not equal losses to muskrats and other consumers. A temporary reduction in water level in an open marsh will result in a "germination" phase in which sedges and cattails flourish. The resulting dense stand of vegetation may not be conducive to diversified wildlife populations but following reflooding, flotation (uprooting and drifting of plant clusters) or herbivore action will reopen the area. The resulting interspersion of emergent cover will produce a productive "hemimarsh". The role of herbivores, such as muskrat, is extremely important in this process. Marsh invertebrates clearly respond to water and vegetative stages of marsh development and appear most productive in the "hemimarsh" stage, thereby accounting for its high productivity in terms of birds.

Portions of the Project Area, particularly Survey Areas 1 and 4 and to a lesser extent 2, apparently have undergone periods of change in water level and plant growth. Water levels have been low in large portions of these areas as a consequence of drainage through the existing canal system, or due to low precipitation in some years. During low water, plant growth proliferated (river bulrush, canary grass) and the quality of these habitats was reduced for typical marsh birds. Recently water levels have risen again, perhaps in part due to beaver activity, and this has increased interspersion, invertebrate productivity, herbivore action and, in general, brought about an increase in bird diversity. Changing water levels often are interpreted as signs of disturbance but the effects, as indicated here, may be beneficial rather than detrimental to habitats and wildlife.

The future of the Project Area as habitat for marsh birds is dependent upon retention of Survey Areas 1, 2 and 4 as hemimarsh habitat of equal or superior quality to what now exists. Removal of any one of these areas, or any development that further isolates the areas from one another, will sufficiently reduce the total amount of this marsh type to jeopardize continued use of any part of the area by typical marsh species (e.g. Common Gallinule, Black Tern). Continued use of the area by migrating waterfowl also is influenced by the availability of open water in these particular Survey Areas. Use of the Project Area by molting or breeding waterfowl is dependent upon the open water and cover found in these areas. When the river is at flood stage, water for ducks is available over large portions of the floodplain. At other times, however, most ducks are dependent upon the standing water of the marshes where food availability is high.

The present value of the Project Area as wildlife habitat is rated as high and, barring changes in water levels or area size, we envision habitat quality remaining similar to what we recorded or even improving in years to come. The probability is high that additional wetland species of birds will use the area if hemimarsh conditions persist in Survey Areas 1, 2 and 4. It also is likely that the breeding populations of Black Terns, Common Gallinules and othe typical marsh dwelling birds will increase as the progeny of established breeding pairs return to this area to nest.

The Project Area provides good quality fish habitat as well, as indicated by the number (32) and kinds of species present. A number of the fish species present in the area are indicators of good water quality. The fishes appeared to be free from major infestations of parasites or diseases and generally in good condition. In addition to the main channel of the Des Plaines River, significant habitat for fish species is provided by the canals, lakes, marshes and floodplain within the Project Area. These diverse habitats provide varied sites for reproduction allowing for the continued existence of a relatively diverse fish fauna within this limited geographic area. This area may thus serve as a refuge for many fish species within the Des Plaines River, which has been negatively impacted due to pollution and disturbance in its lower reaches. The importance of the floodplain as seasonal spawning and rearing areas for northern pike and other game fishes (total of 6 species) is increasing because comparable areas are essentially nonexistent elsewhere along the Des Plaines River. Four other game fishes were observed on the area, but breeding was not verified. These game species can provide a valuable recreational resource for individuals in the area.

The diversity of amphibians, reptiles and mammals recorded on the Project Area indicates that habitat quality is suitable for the needs of a wide array of vertebrate species in addition to fishes and birds.

HYDROLOGICAL AND ASSOCIATED VALUES

Wetlands retain water from rain, snow melt and other sources on the local landscape thereby permitting it to percolate into the water table. In addition, riverine wetlands function as a floodplain thereby providing space for flood swollen rivers to expand into, deposit part of their silt load, purify their waters and otherwise reduce the impact of flooding at downstream locations. These types of wetland functions are becoming better understood as well as appreciated by the public. Retention of wetlands and floodplains is an economical and efficient way of reducing flood losses and also altering the alarming rate at which ground water supplies are being diminished.

We are experiencing a destructive loss of freshwater marshes in the United State at the rate of 0.5-1.0% annually through drainage and other forms of exploitation (Ref. 9). As we approach the end of this century, there are signs we are encountering acute stress for usable freshwater. Contemporary needs for freshwater resources exceed availability in several large regions (e.g. the Northeast, Florida). Dependence upon ground water reservoirs will increase in coming decades in all areas. To be utilized effectively within a regime of fluctuating climatic replenishment, these reservoirs must be refilled in a systematic manner from surface catchment sources (Ref. 9). Wetlands play an important role in such replenishment. These long-term considerations should outweigh the relatively short-term needs that often threaten wetlands.

Wetlands also may serve as nutrient traps wherein nitrogen and other compounds leached from agricultural fields or included in effluent from sewage treatment plants, septic systems or livestock operations are filtered from the water by vegetative action or other processes. Wetlands may assist, therefore, in the purification of runoff before it moves into a major river system and travels downstream. The Des Plaines wetland is largely vegetated and has the potential for provision of this important function.

The floodplain of the Des Plaines River has the potential for holding back substantial quantities of flood water thereby reducing the flood hazard downstream. The porous soil and vegetated surface of the broad floodplain retards the rate at which water enters the river. The 100-year floodplain of the river covers an extensive portion of the Project Area (see Part 1, Fig. 1-2 A&B), and provides an efficient and economical means of impounding water and reducing floods along the developed sections of the Des Plaines River. An increase in water depth of about

15 centimeters (6 inches) within a 10 acre (4.2 hectare) wetland results in 1.5 million gallons of water being retained (Ref. 10). The Project Area, therefore, has the potential for playing a significant role in flood control and the maintenance of ground water supplies. During flooding, the wetland contributes to water filtration, provides wildlife habitat and serves as a spawning and rearing area for several species of game fish. The Des Plaines River wetland is considered by the Wisconsin Department of Natural Resources as the last extensive wetland in southeastern Wisconsin (Ref. 11). This being the case, the value of the area for all of the purposes discussed in this report is increased significantly, as alternate sites of similar size, potential, and characteristics do not exist in the area.

RECREATIONAL VALUES

The Des Plaines River and the associated wetlands provide a large number of man-use days of recreational activity on an annual basis. During the 1979-80 study period, we observed the following activities being conducted within the Project Area on a repeated basis: upland small game hunting, waterfowl hunting, deer hunting (gun and bow), fishing (rod and bow), furbearer trapping, tent camping, canoeing and hiking.

Hunting was the most frequent type of recreational use we observed. Members of the Pheasant Valley Hunting Club used the area on a regular basis and other hunters (non-members) hunted portions of the area during the regular hunting season. Two duck blinds were constructed on or near Survey Area 1 in 1979 (Pheasant Valley Hunting Club property). Other hunters used natural cover for blinds along the dikes bordering Areas 1 and 5 and at numerous locations along the river. Occasionally duck hunters were observed on the Girl Scout property (Survey Area 2) although an attempt was made by the owner to exclude hunters. The area north of the "Q" canal also was hunted rather heavily. Blinds were constructed on the marsh (Survey Area 4) in 1979 and 1980. During our fall aerial surveys, hunters were observed at locations throughout the Project Area, particularly during waterfowl and deer seasons. The area has significant value as habitat for wildlife species that are harvested by hunters. Our bird inventory includes a significant number of game species that occurred regularly on the Project Area. Our aerial surveys indicated more waterfowl (species and individuals) used the Project Area than any adjacent property, including the floodplain west of I-94. The recreational value of the Project Area to area hunters is significant as is their contribution to the local economy.

Fishermen entered the area from several access points. They fished from bridges, canoes and the banks. The presence of one or more fishermen during our visits to the Project Area was not unusual. Fishermen, however, were a minority compared to hunters. The variety of game fishes found on the Project Area represents an attractive resource for use by this group of sportsmen. Again, this activity is of regional economic value and the recreational activity provided is important to the participants and to the surrounding communities.

Trapping for muskrats and other furbearers occurred in 1979 and 1980 on the Project Area. Trappers worked most of the marshes on the Pheasant Valley Hunting Club property. At current market prices, a successful trapping operation would provide a good supplemental income as well as recreational benefits. All of the forms of wildlife harvested from the wetland represent a renewable resource (under proper management) that can provide these types of benefits on an annual basis.

Camping was conducted on several occasions on the Girl Scout property by groups of persons. These organized groups obtained recreational as well as educational values from the wetland and the adjacent upland areas. Such experiences are of immeasurable benefit to the individuals involved and to society. The availability of a regional resource that can satisfy these needs is of significant value to a community.

Canoes were observed along the rivers and on the floodplain on several occasions. Sometimes fishermen used canoes to reach fishing spots but other times the individuals simply were enjoying the experience of traveling along the slow-moving river. The natural surroundings and wildlife present along the river make it an enjoyable place for this purpose, particularly during periods of high water. In spring, hikers were observed on numerous occasions along various portions of the river. The fact that people selected the undeveloped terrain along the river for this purpose suggests that there is a paucity of suitable sites in the area for such purposes.

Our observations indicate the Project Area plays an important role in the outdoor activities of a sizeable group of people. As a result, retention of the Project Area as open space would benefit many people. Any action that would reduce the quality of the area's wildlife habitat also would detrimentally influence the recreational values the area offers.

ECONOMIC VALUE OF STREAMSIDE WETLANDS

The Illinois Institute of Natural Resources (Ref. 12) has appraised the economic value of natural wetland functions. In a study of the wetlands along the Kankakee River in northeastern Illinois, they calculated the cost of replacing the functions of this ecosystem through technology. Their study area incorporated a six-mile section of floodplain forest, marshes, sloughs and upland forest that bears considerable resemblance to the Des Plaines River Project Area. In fact, the Kankakee River joins the Des Plaines River in the northeast corner of Grundy County (Illinois) to form the Illinois River. The two watersheds also are similar with respect to man's influence on them. Ditching, tiling and related activities have changed drainage patterns and resulted in only remnants of the original wetlands remaining. The conclusions from the Kankakee River study (Ref. 12) are presented here as an indication of the potential value of some of the natural functions or services provided by the Des Plaines wetlands in Kenosha County, Wisconsin.

The natural or public service functions of wetlands include fish and wildlife protection, flood control, drought prevention, water quality enhancement and sedimentation control. (Other services, such as recreation, could be added to this list but they were not included in the Kankakee calculations.) The cost to the region to replace all of the ecosystem services provided by the Kankakee wetlands amounted to $494/acre per year (Ref. 12). If the Des Plaines wetland is considered comparable in quality, the value of the services provided by the 1500 acre (approximate) Project Area would be $741,000 annually. Since the Kankakee study did not consider all possible sources of value, this figure is considered minimal.

Wetlands also have been evaluated by other investigators with respect to their economic value to mankind. A Georgia study (Ref. 13) estimated the value of wetlands at $3,126/acre per year, or 8.33 times the acreage value arrived at in the Kankakee study. The sizeable difference between the two sets of figures is the result of the Georgia study including values to education and public use (recreation) in addition to those considered in the Illinois study. Another Illinois study examined the value of a cypress swamp along the Cache River as a flood control reservoir and as a means of removing excess phosphorus from floodwaters (Ref. 12). The estimated value based on these two functions alone was $246/acre per year.

If the annual social value of an acre of wetland is considered to be $500 (as in the Kankakee study), income-capitalization (Ref. 14) of these data at five percent interest yields a per acre valuation of $10,000. Obviously this figure would be higher if other important values were included.

This approach provides an added indication of the value of wetlands such as those found in Kenosha County, Wisconsin. (It is not intended, however, to indicate actual retail value of the property.) The descriptions provided in this report of the value of the Des Plaines wetland as fish and wildlife habitat and the estimates of its contribution to the economic well-being of the region appear sufficient to justify preservation of the wetlands in their natural state.

COMMENTS ON HUMAN INTRUSION WITHIN THE PROJECT AREA

The most obvious forms of disruption to the natural processes of the area have been the attempts of man to drain large portions of the wetlands. The use of dikes, canals and pumps to control water levels in the past seriously altered the habitats present on the area and these structures are still influencing patterns of water flow. Abandonment of maintenance of the dike and canal system at some point in time, and an apparent decline in attempts to farm the floodplain have permitted conditions to revert back to something resembling what existed earlier. Evidence of disturbance is obvious but a good variety of wetland habitats and the associated forms of wildlife have returned. Except to the extent that they may detrimentally affect water levels, the circumstances of the past are insignificant. The wetland has the potential for recovering from these former intrusions and it is well on its way toward doing so.

Maintenance of water levels similar to those observed in 1980 is important to use of the hemimarshes by marsh-nesting birds. Muskrats and beavers are destroying the dike system and this could alter the distribution of water in some areas. The west end of Survey Area 4, for example, has a dike between the marsh and the river. Loss of the dike could hasten drainage of the area thereby reducing its value to wetland species. Without the associated canal (manmade) this danger would not be as severe since the basin of the wetland would be capable of retaining sufficient water to maintain marsh vegetation. As is, however, the deeply dug canal drains water out of the marsh and in the absence of the west dike would emit water until it reached a level similar to that of the river. Even if this happened, the value of the area to wildlife would not be lost, but there would be a change in species composition and diversity. A variety of wildlife also use habitats that do not remain flooded all year but species such as Black Terns, Common Gallinules and Least Bitterns would be lost. Given time, no further drainage attempts, and prevention of the "Q" canal from joining the river, the habitats available on the Project Area should improve in quality for most forms of fishes and wildlife.

Hunter activity is compatible with use of the wetlands by wildlife. Hunter activity is concentrated in the fall after the breeding season. This allows breeding birds to use the area undisturbed during the summer (no disturbance was recorded in the marshes during spring or summer) and also during spring migration. This activity as well as fishing, is not considered as unusually disruptive to the ecological values of the Project Area.

Present agricultural activities on the uplands bordering the Project Area have little impact. There was little evidence of siltation from agriculture on the Project Area, although the river carries a heavy silt load from upstream sources. Water entering the river from the nearby electric power plant and from the Pleasant Prairie sewage treatment plant is a potential source of pollutants. Most parts of the wetland (except for the river) had reasonably clear water and the invertebrate populations reported in this study support this contention. The only significant evidence of introduced silt into the Project Area wetlands from surrounding activities occurred in 1980. Effluent pumped from the gravel pit operation located northeast of Survey Area 4 entered the pond at the northeast corner of Survey Area 1 and also the "Q" canal system. The water emitted from a large pump at the gravel pit entered a ditch paralleling the railroad tracks and flowed southward to enter the wetland. The eastern portion of Survey Area 4 also was affected by this process. The water entering the wetland was beneficial but the heavy silt load was not. The area impacted by silt was used by spawning northern pike in the early spring of 1980, prior to the onset of pumping. The suspended silt in the water of these areas also detrimentally affects growth of submergent vegetation and associated invertebrate production which, in turn, influences fish and wildlife activities. Drainage of the gravel pit effluent directly into the wetland should not continue. A settling pond should be established on an upland area to trap the silt. The clear, clean water should be allowed to enter the wetland.

Sometime prior to this study, a portion of Survey Area 4 apparently was filled with spoil from the gravel operation. This procedure apparently reduced the size of this important hemimarsh area by perhaps 40-50 percent. The area's contour lines bordering the dark-shaded areas in Figure 1-2 A&B (Part 1 of this report) probably delineate the original extent of this wetland. Returning this marsh to its original size would result in an area having even greater importance for nesting purposes for marsh birds that are becoming increasingly rare. Area 4 had a good representation of breeding and migrant marsh birds, including Common Gallinules, Black Terns and numerous waterfowl. The populations of these species probably would respond favorably to enlargement of the area. Following removal of the fill, typical marsh vegetation would invade from existing nearby stands and within a few years habitat quality would be optimal. The populations of wetland birds would respond favorably to enlargement of the area as there would be space for more breeding pairs. Loss of Area 4 as a consequence of further filling would seriously reduce the amount of hemimarsh available on the Project Area.

The dike system bordering Survey Areas 1, 4 and 5 has two water control valves at the west end of Area 4. These valves (one at the southwest corner, the other near the northwest corner of Area 4) can be opened to permit water to flow out of the marshes and into the river. Because beaver have cut through the dike in places, movement of water out through these valves influences water levels in all three survey areas. During the last two weeks in October 1980, the water level in Areas 1 and 4 was declining at the rate of about 0.3 meters per week. This was the result of someone opening the southwest valve and cleaning out the culvert leading into it. The water had dropped by 0.6 meters before the valve was closed on 31 October. Within two weeks thereafter, the water level returned to its prior level (gained 0.6 m). It is important that these valves remain closed, otherwise water depth will be reduced to the point that wildlife values will be changed significantly.

It is obvious the Project Area has been tampered with by man over a series of years. It would be improper, therefore, to refer to the area as a natural area. This fact, however, does not reduce its value as a wetland or significantly reduce its effectiveness in performing typical wetland functions (e.g. wildlife production, fish production, flood control, recreation, etc.). Data contained in this report show conclusively that the Project Area serves as quality habitat for a wide variety of fishes and wildlife. The importance of the area's habitats will increase in decades to come as will the other wetland values it offers.

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PART 8: PROJECT SUMMARY

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An evaluation of wetland habitat quality was conducted along the Des Plaines River, Kenosha County, Wisconsin during October through November 1979 and March through November 1980. The study emphasized species occurrence and abundance as indicators of habitat quality. Inventories of the following groups of biota were conducted: birds, fishes, invertebrates, other vertebrates (mammals, reptiles, amphibians) and plants. The animal groups are listed according to the relative amount of effort devoted to inventorying each group.

A total of 173 bird species (19 waterfowl; 19 other waterbirds; total of 73 wetland-associated species) were reported from the Project Area. About 95 percent of the waterfowl recorded during aerial surveys in the vicinity were sighted on the Project Area. Numerous waterfowl used the Project Area during spring. Fall concentrations provided hunting opportunities for a number of persons. During 1980, 399 nests of 13 marsh dwelling species were located. Nest searches were restricted to areas of hemimarsh. Two endangered and three threatened bird species were recorded on the Project Area.

The fish inventory indicated 32 species, including 10 game species, occurred within the Project Area. Six of the game species were documented as breeding there, as were 13 nongame fishes. The fish fauna is considered to be relatively diverse on the basis of these data.

The number of invertebrate taxa (over 80) located at the various sampling stations was considered typical for similar habitats in the Upper Midwest. High species diversity occurred in the hemimarshes thereby increasing the value of these areas for wildlife species.

Five species of amphibians (4 frogs, 1 salamander), five reptiles (4 turtles, 1 snake) and 13 mammals were recorded. Beaver and muskrats were permanent residents on the Project Area. One beaver lodge and dam was located and 310 muskrat houses were recorded in 1980 within the bird survey areas. One threatened reptile (Blanding's turtle) was recorded on several occasions.

Fifteen plant communities were identified within the

Project Area. A total of 408 plant species were identified. Although no threatened or endangered species were located, two of the species are considered to be rare as the specimens found represent the first records for Kenosha County, Wisconsin.

All of the aquatic areas that support submerged or emerged vegetation are rated as having high quality from the standpoint of plant species diversity, the presence of native species and the existence of little evidence of community disturbance. Wetland meadows bordering ponds and depressions (Community Type 6) had the highest species diversity (103 species) of any of the wetland communities.

Habitat quality is considered good to very good for the groups inventoried. Various procedures were used to evaluate habitat quality and each of the methods produced similar results. The wetland (1) has high wildlife and fisheries values; (2) plays an important recreational function in the area; (3) serves a critical role in flood control, ground water supply renewal and filtration; and (4) represents a rapidly diminishing landform and ecosystem in the region. The annual value of these ecological services to the region was estimated.

Although the area has been impacted by human activities in the past, considerable natural repair has occurred. As a result, habitat quality shows signs of recent improvement and continued enhancement of quality is anticipated, barring further human attempts at dredging or filling. The Project Area is considered an important ecological area because of the wildlife, fisheries and related values identified in this report. These values appear important enough to justify protection of the area from activities that would reduce wetland quality. The Des Plaines wetlands in Kenosha County appear vital to the future of the river. Loss of the marshes, wet meadows, floodplain grasslands and forests, and other habitats would reduce significantly the variety and abundance of wildlife and fishes associated with this river system.